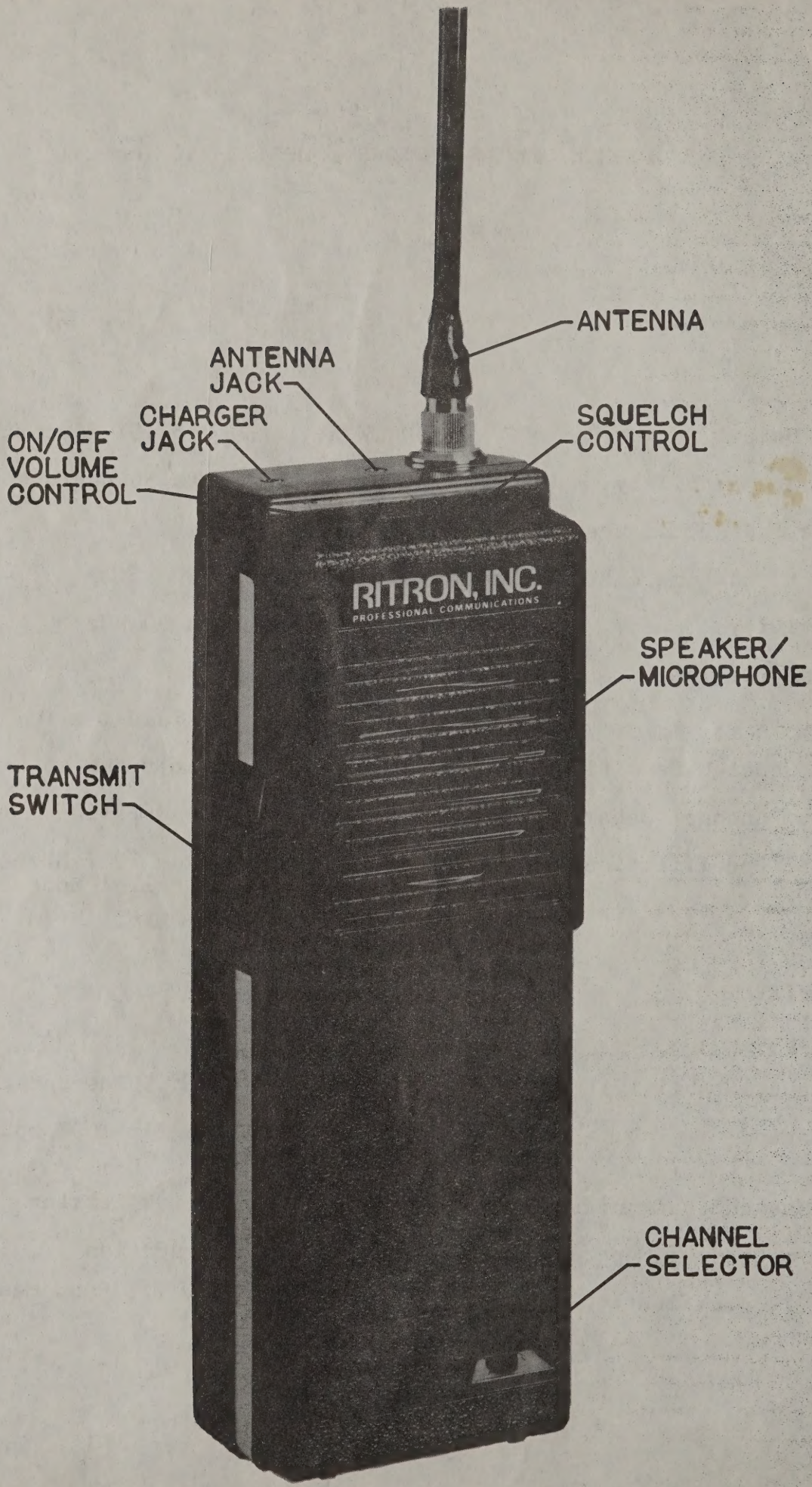
PERFORMANCE SPECIFICATIONS MODEL RT-150 (cont.)

RECEIVER

Audio Output:	350 mW at less than 10% distortion
Frequency Stability:	± .001% from -30 to 50 degrees C
Modulation Acceptance:	± 7.5 KHz Maximum
Spurious and Image Rejection:	Greater than 55 dB
Selectivity:	More than 60 dB at 30 kHz
Intermodulation:	More than 60 dB
Sensitivity:	.35 uV for 12 dB sinad max
Noise Squelch Sensitivity:	.18 uV to .75 uV adjustable
Maximum Channel Separation:	1 MHz with no degradation
Crystal Specification:	(Receive Frequency - 10.7 MHz) / 3 Third Overtone, Parallel Mode 32 pF

TRANSMITTER

RF Output:	1.0 watts
Frequency Stability:	± .001% from -30 to 50 degrees C
Modulation:	Type 16F3, ± 5 KHz for 100% modulation at 1000 Hz
Spurious and Harmonics:	More than 53 dB below carrier
Maximum Channel Separation:	1 MHz with no degradation
Crystal Specifications:	Transmit Frequency/12, Fundamental mode 32 pF


ANTENNA
ANTENNA JACK
CHARGER JACK
ON/OFF VOLUME CONTROL
SQUELCH CONTROL
RITRON, INC.
PROFESSIONAL COMMUNICATIONS
SPEAKER/ MICROPHONE
TRANSMIT SWITCH
CHANNEL SELECTOR

RT-150 OPERATING INSTRUCTIONS

The RT-150 is a two-way radio operating in the VHF-FM communications band. This radio has the capability of transmitting and receiving frequencies assigned to you by the FCC and MUST BE LICENSED BEFORE USE. Your Ritron Dealer will help you obtain a FCC license.

This unit may be equipped with either a telescoping whip or a flexible spiral antenna. You should always extend the telescoping whip antenna before transmitting and for optimum receiver performance.

This unit contains an internal battery pack that may have become discharged during shipment. It is recommended that the charger cube included with the radio be plugged into the unit for at least 8 hours to bring the batteries to a partial charge before first using the transceiver.

The Off/On control for the radio is incorporated with the volume adjustment control. Turn this knob clockwise to turn the unit on. Further rotation will increase the volume of a received signal.

The squelch control can be set by the user to eliminate the static between transmissions. Rotate the squelch control counter-clockwise until noise is heard and then set the squelch by rotating the control clockwise until the noise is eliminated.

If the radio is equipped with a CTCSS (sub-audible) tone squelch system, it may be activated by turning the squelch control fully counter-clockwise. The tone squelch circuit is activated only by transmissions using the tone squelch code installed in the unit. If you have tone squelch, always turn it off and monitor the channel before transmitting to avoid interference with other users of your channel.

To talk to other stations simply push the transmit switch on the side of the case and hold it down while speaking into the grill at the top front of the case. Hold the radio about 2 inches from your lips and speak in a normal tone. Release the transmit switch to hear a reply.

The channel selector allows you to select either of two frequencies that can be installed.

When the radio's batteries are discharged turn the unit off, plug the charger into the charging jack at the top left of the case, plug the charger into a 110 VAC wall outlet and allow the batteries at least 10 to 14 hours to fully charge.

THEORY OF OPERATION MODEL RT-150

RECEIVER

The RT-150 transceiver has a 2 channel crystal-controlled, dual conversion, superhetrodyne FM receiver. Power is supplied by 6 "AA" Nickel-Cadium rechargeable batteries connected in series.

RECEIVER RF-IF-DETECTOR-AUDIO

A signal applied to the antenna jack or from the attached antenna passes thru the antenna switch to a common base RF AMPLIFIER (Q101) via two section Filter (L102, L103, C102, C103, C104). A single section filter (L105, C107) further reduces the RF bandwidth and is coupled to the first mixer (Q102). The receiver first local oscillator is a crystal controlled Clapp type built around Q103. The resonant circuit of L107, C138 selects the third harmonic of the oscillator for injection to the mixer. The mixer output is matched into a two pole monolythic crystal filter YF101 centered at 10.7 MHz. CR201 clamps the 10.7 MHz to prevent overdrive of the second mixer. IC101 is a multifunction FM IF integrated circuit. The 10.7 MHz IF signal is applied to pin 16 of IC101 which is the input of a balanced mixer. The 2nd L.O. crystal (Y103) is driven by IC101 pins 1 and 2. The L.O. signal also drives the balanced mixer. The mixer provides a 455 KHz 2nd IF signal at pin 3. A 455 KHz, 4 pole ceramic filter (YF102) is connected between the 2nd mixer output (pin 3 IC101) and the input to the limiting IF amplifier (pin5, IC101). The output of the limiter (pin7) drives a multiplier, both internally and through a quadrature coil, (T103) to detect FM. The recovered audio present at pin 9, is deemphasised by R116 and C123, attenuated by the volume control (R117) and applied to IC102, a .35 watt audio amplifier with a gain of 50. The audio output is connected thru the past to talk switch and C126 to the 8 ohm speaker, SP 1.

SQUELCH CIRCUIT

An 8 KHz bandpass filter is built around an on-chip inverting operational amplifier, (pins 10 and 11 of IC101). This op-amp amplified 8 KHz noise which is applied to a biased noise detector (CR102). The output of CR102 is connected to a Schmidt trigger (pins 12, 14, IC101). Pin 14 is grounded in the presence of noise and high when no noise is applied to CR102. An on-channel carrier therefore causes pin 14 to be high and allows IC102 to function as an audio amplifier. When noise is present at CR102 the output of the Schmidt trigger is low, which mutes the audio

amplifier. R121, the squelch control sets the threshold of squelch action.

TRANSMIT/RECEIVE PUSH-TO-TALK SWITCH

In receive, the speaker is connected to the output of the audio amplifier thru SW1A. The receiver input is connected to the antenna through SW1B. SW1B also applies battery voltage, isolated with chokes, to the receive circuitry. In transmit the speaker is used as a microphone and its output is applied to the input of the speech amplifier. The transmitter output and the transmitter B+ is switch to the combined antenna and choke fed B+ distribution buss.

TRANSMIT SPEECH AMP

The transmitter speech amplifier limiter and low pass filter, (Q205, Q206, Q207 and Q208 and associated components) limits the amplitude and frequency components of the voice signal prior to application to the modulator. R220 is used to set the maximum voice modulation deviation, Q205 and Q206 amplify and provide preemphasis prior to limiting in Q207. Q208 and associated circuitry provide a -18dB/octave characteristic for frequencies above 3 KHz.

TRANSMITTER

The transmitter frequency is controlled by a crystal oscillator Q201. CR201 acts as a voltage variable capacitance modulator to vary the frequency of the crystal oscillator. Variable capacitors (C202 and C203) are included for netting the transmitter on frequency. L203, C209 and C210 select the 3rd harmonic of the crystal frequency and match it into the base of Q202, a doubler. L204, C211 and L205, C214, C213 are coupled by C212 and are tuned to the 6th harmonic of the crystal frequency. This signal is applied to the base of Q203, a doubler. Two coupled resonant circuits L206, C215 and L207, C217, C218 coupled by C216 are tuned to the 12th harmonic of the crystal frequency. This signal is amplified by Q204 to approximately 1 watt, then matched to 50 ohms by C219 and L209. An elliptic function, low-pass filter (C220, 221, 222, L210) removes harmonics and is connected to the antenna switch. An antenna may be attached to the 2.5mm jack or the threaded connector.

RT-150 TUNE UP PROCEDURE

TEST EQUIPMENT REQUIRED:

1. 0 to 10 Volt, 1 Amp, Current Limited Supply
2. RF Watt Meter, 3 watts full scale
3. RF Signal Generator
4. Deviation Meter
5. Frequency Counter (to 174 MHz)
6. VTVM or DMM
7. RF Voltmeter (to 174 MHz)
8. Sweep Generator (10.7 MHz IF alignment only)
9. Oscilloscope
10. RF Detector (Figure 2)

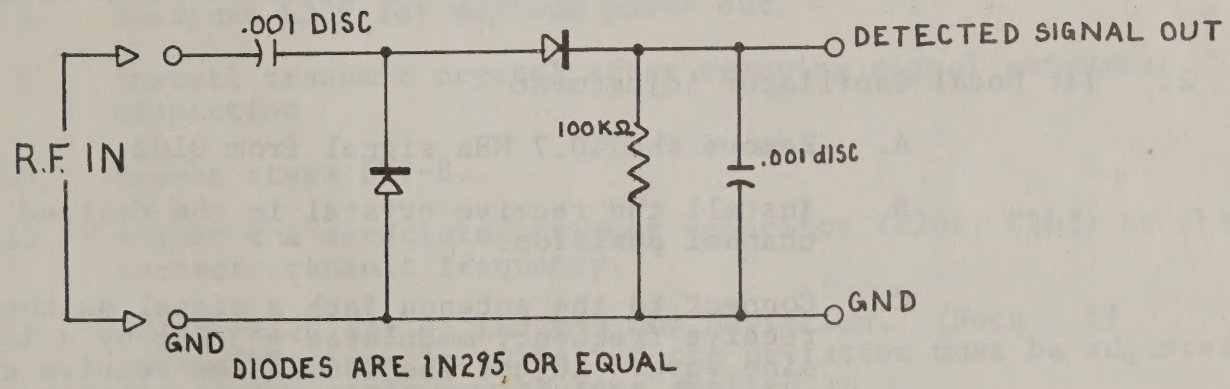


Figure 2

RADIO PREPARATION:

1. Remove antenna from threaded fitting.
2. Open unit by removing 2 #4 screws from the rear cover.
3. Disconnect and remove the battery pack.
4. Connect to 8.0 VDC, 1 amp limited supply thru charger jack on top of unit.

RECEIVER ALIGNMENT

1. I.F. Sweep Alignment

NOTE: This adjustment should not vary significally from the factory alignment and should not be required in the field.

A. Through a D.C. blocking capacitor (.001 mfd) inject a signal swept ± 25 KHz about 10.7 MHz at the base of Q102.

B. Connect the A.C. Detector (Figure 2) to pin 16 of IC101.

C. IF required, Adjust T101 and T102 to provide a passband of 15 KHz centered on 10.7 MHz.

D. Remove the detector from IC101 pin 16.

E. Thru the blocking capacitor in part A, inject a 10.7 MHz signal modulated ± 3 KHz by a 1 KHz sinewave.

F. Adjust T103 for maximum audio or SINAD on R117.

2. 1st Local Oscillator Adjustment

A. Remove the 10.7 MHz signal from Q102.

B. Install the receive crystal in the desired channel position.

C. Connect to the antenna jack a signal on the receive frequency modulated ± 3 KHz by a 1 KHz sine wave. Adjust the associated receive crystal trimming capacitor for best SINAD at R117.

D. Alternately, remove the 1 KHz modulation and adjust crystal trimmer for maximum quieting.

3. Filter and RF Amplifier

A. Use set-up as described in Section 2.

B. Adjust L102, L103, L105 for best SINAD or quieting.

C. Decrease the signal input and repeat B until maximum sensitivity is achieved.

TRANSMITTER ALIGNMENT

NOTE: The following adjustments may all be made from the bottom of the board. Key the transmitter by depressing the P T T switch for each measurement.

1. Connect a RF signal generator set at an output frequency of exactly one-fourth the desired channel frequency and 0 dBm to the crystal solder socket via a .01 mfd ceramic capacitor. Crystal should not be installed.
2. Set R220 fully C.C.W.
3. Using an RF voltage probe (RF voltmeter or detector & VTVM) on the base of Q202, adjust L203 for maximum RF.
4. Move the RF probe to the base of Q203 and adjust L204 and L205 for a maximum.
5. Move the probe to the base of Q204 and adjust L206 and L207 for a maximum.
6. Adjust L209 for maximum reading on the wattmeter.
7. Readjust L207 for maximum power out.
8. Readjust L209 for maximum power out.
9. Install transmit crystal after removing signal generator connection.
10. Repeat steps 6-7-8.
11. Adjust the associated trimmer capacitor (c202, C203) to the correct transmit frequency.
12. Adjust R220 for ±5 KHz maximum deviation. (Note: if subaudible tone is installed the deviation must be adjusted for ±5 KHz maximum with tone applied.)

NOTE: These adjustments are sensitive-do not turn too far.

RT-150 Receiver Voltages

DC Voltage Chart with:
Receiver unsquelched
Channel Selector on installed crystal
No signal input
PTT switch in receive position
+7.5 VDC battery

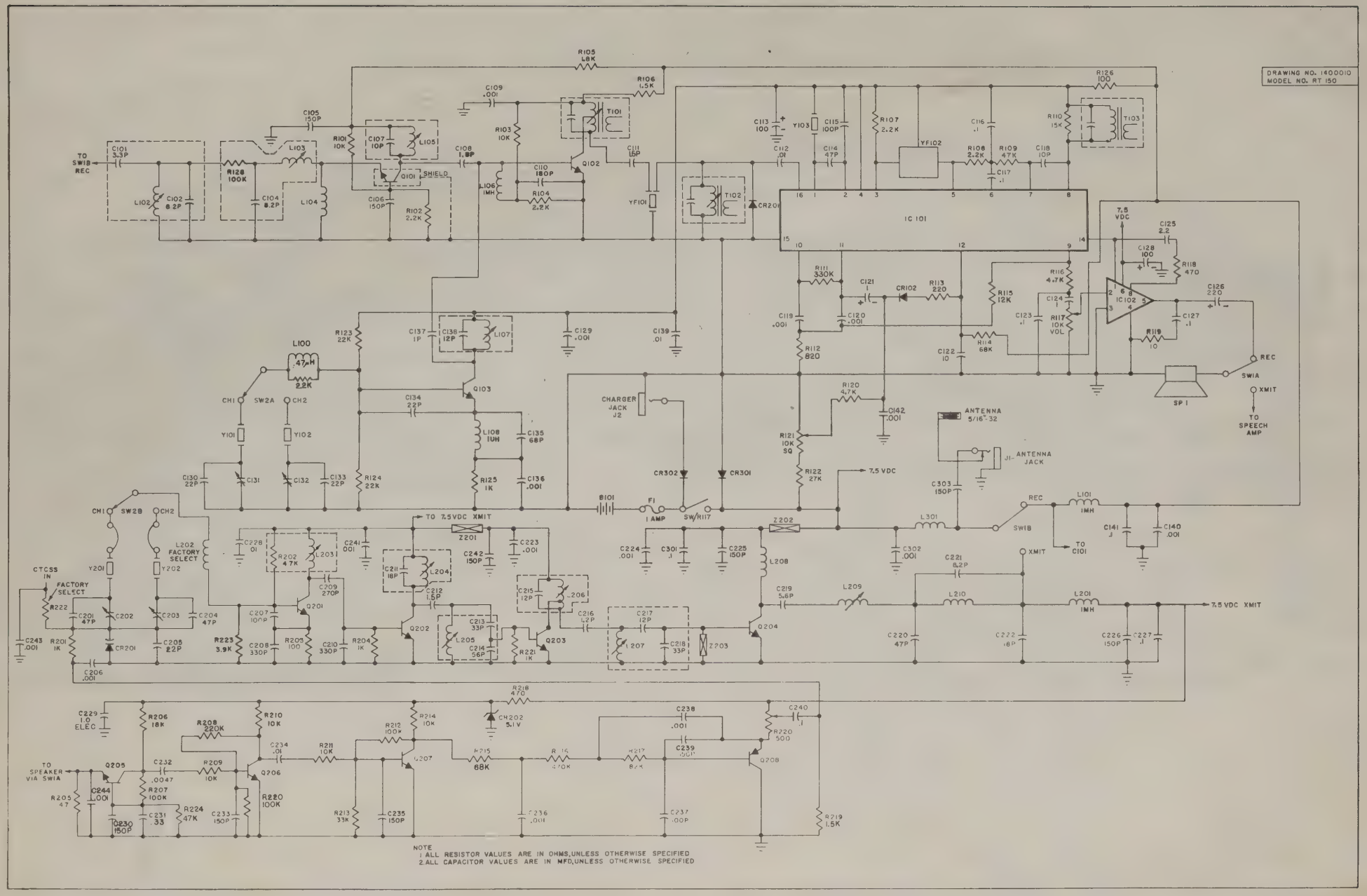
Device	Pin	VDC	Device	Pin	VDC
Q101	E	0	IC102	1	1.3
"	B	.7	"	2	0
"	C	4.2	"	3	0
Q102	E	0	"	4	0
"	B	.5	"	5	3.8
"	C	3.3	"	6	7.5
IC101	1	7	"	7	not used
"	2	6.5	"	8	1.3
"	3	7	Q103	E	3
"	4	7.2	"	B	2
"	5	1	"	C	7.2
"	6	1			
"	7	1			
"	8	7			
"	9	3			
"	10	2			
"	11	2			
"	12	1.4			
"	13	not used			
"	14	1.3(squelched)			
"	15	0			
"	16	2			

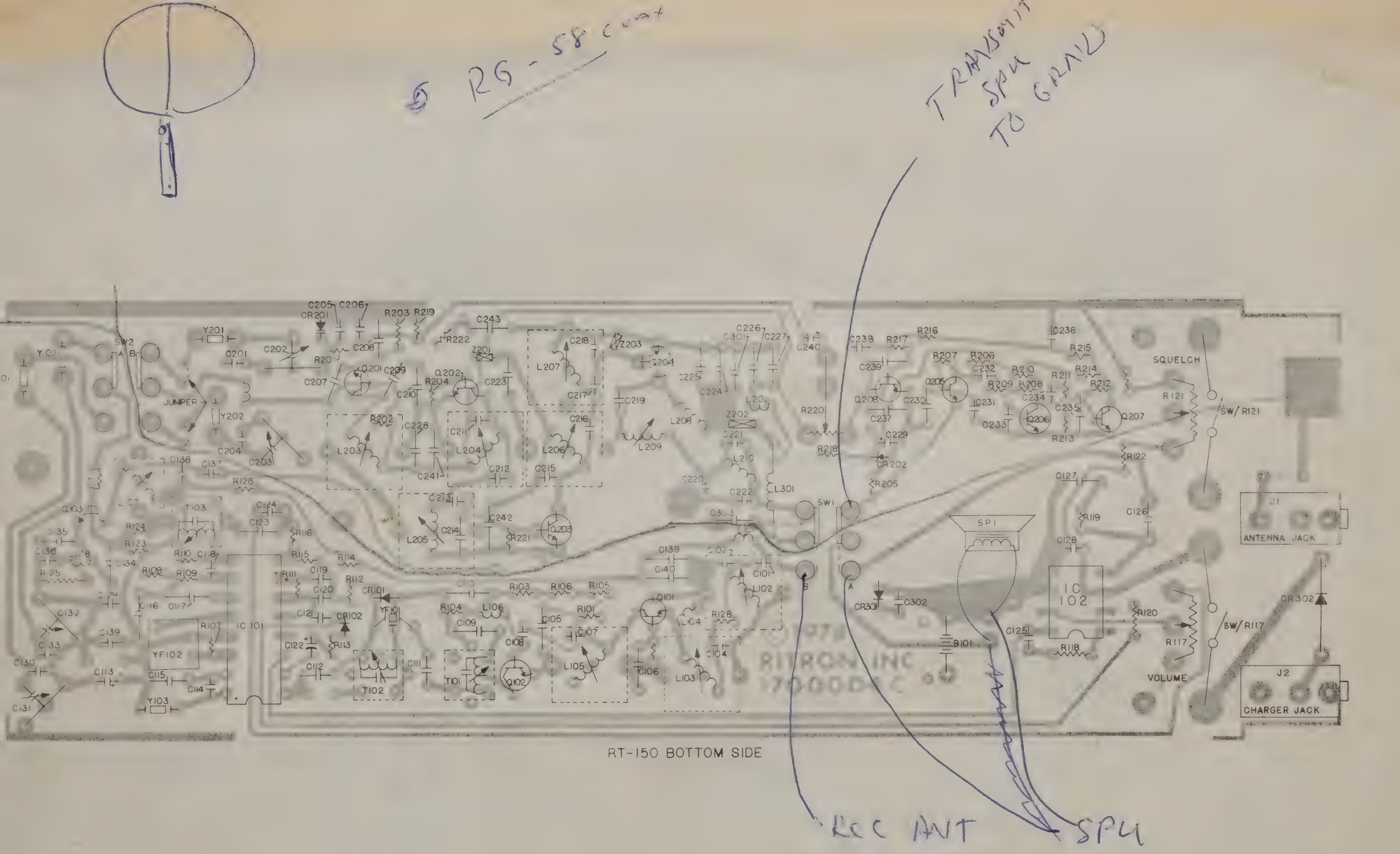
RT-150 Transmitter Voltages

DC Voltage Chart with:
PTT switch in transmit position
+7.5 VDC battery

Device	Pin	VDC	Device	Pin	VDC
Q205	E	0	Q201	E	NA
"	B	.55	"	B	NA
"	C	.7	"	C	7.5
Q206	E	0	Q202	E	0
"	B	.6	"	B	1.8*
"	C	2	"	C	7.5
Q207	E	0	Q203	E	0
"	B	.56	"	B	4*
"	C	2.5	"	C	7.5
Q208	E	3.8	Q204	E	0
"	B	2.5	"	B	2.2*
"	C	0	"	C	7.5

* Voltages measured using Ritron detector (Figure 2.)


DRAWING NO. 1400010
MODEL NO. RT 150
IC 101
IC102
SP 1
ANTENNA 5/16"-32
ANTENNA JACK
CHARGER JACK J2
TO SWIB REC
TO SPEECH AMP
TO SPEAKER VIA SWIA
CTCSS IN
FACTORY SELECT
L202 FACTORY SELECT
TO 7.5VDC XMIT
7.5 VDC
7.5 VDC XMIT
TO C101
XMIT
REC
SWIA
SWIB
SW2A
SW2B
CH1
CH2
NOTE
1.ALL RESISTOR VALUES ARE IN OHMS,UNLESS OTHERWISE SPECIFIED
2.ALL CAPACITOR VALUES ARE IN MFD,UNLESS OTHERWISE SPECIFIED



RT-150 BOTTOM SIDE

RT-150 TONE INSTALLATION DRAWING

SUB-AUDIBLE TONE INSTALLATION

A Tone Installation Drawing is shown on the reverse side of this sheet for RITRON, INC. tone boards RME-3 (Encode only) and RTS-1JR (Encode and Decode).

Other brands and types of tone encoding and decoding circuits may be interfaced with the radio if desired. Following are the recommended points for attaching such circuits:

Receiver Output Signal:	Junction of R116, C123, & C124
B+ Voltage (7.2 VDC):	Output of ON/OFF Switch
Ground:	Any convenient Ground track
Receiver Squelch Point:	Pin 14 of IC102 (Ground to Squelch Receiver)
Transmitter Tone Modulation Input:	Junction of R222 & C243 (R222 is selected to produce proper amount of modulation)
"Hang-Up" Signal:	SPST Switch on Squelch Control

These 6 points are shown on the reverse side of this sheet as part of the Installation Drawing.

Schematic Reference Number	Description	Ritron Part Number
L 206	Inductor, 3.5T Spacewound Coil	1850003
L 207	Inductor, 3.5T Spacewound Coil	1850003
L 208	Inductor, 4.5T .1"ID LHH	1802004
L 209	Inductor, 6.5T Spacewound Coil	1850006
L 210	Inductor, 4.5T .1"ID LHH	1802004
L 301	Inductor, 1 UH	1800107
Z 201	Inductor, Ferrite Bead	1801003
Z 202	Inductor, 2 Ferrite Beads	1801003
Z 203	Inductor, Ferrite Bead	1801003
Q 101	Transistor, MPS-H07	4800003
Q 102	Transistor, MPS-H20	4800004
Q 103	Transistor, 2N3563	4800002
Q 201	Transistor, 2N3563	4800002
Q 202	Transistor, 2N3563	4800002
Q 203	Transistor, 2N4427	4801000
Q 204	Transistor, MRF-629	4801001
Q 205	Transistor, 2N4124	4800006
Q 206	Transistor, 2N4124	4800006
Q 207	Transistor, 2N4124	4800006
Q 208	Transistor, MPS-A64 Darlington	4800008
CR 101	Diode, 1N4148A	4810001
CR 102	Diode, 1N4148A	4810001
CR 201	Diode, MV-2209 Vari Cap	4810011
CR 202	Diode, 1N5231 5.1V Zener	4820006
CR 301	Diode, 1N4001	4810003
CR 302	Diode, 1N4001	4810003
IC 101	Integrated Circuit, MC 3357P IF Subsystem	3131010
IC 102	Integrated Circuit, LM 386N Audio Amp	3131009
Y 101	Receive Crystal	2300004
Y 102	Receive Crystal	2300004
Y 201	Transmit Crystal	2300003
Y 202	Transmit Crystal	2300003
Y 103	Crystal, 10.245 MHz 2nd LO XTAL	2300005
YF 101	Crystal Filter, 10.7 MHz	2301001
YF 102	Ceramic Filter, CFU-455D	2301002
T 101	Transformer, 10.7 MHz IF	5600001
T 102	Transformer, 10.7 MHz IF	5600001
T 103	Transformer, 455 KHz IF	5600002
SW 101	Switch, Push to talk	5100001
SW 102	Switch, Channel	5100002

PARTS LIST CONT.

Schematic Reference Number	Description	Ritron Part Number
R 117	Resistor, 10K Audio with switch	4750010
R 121	Resistor, 10K Linear with switch	4750011
R 220	Resistor, 500 OHM Mini-Pot	4750001
	10 MM Shield Can	2500003
	7 MM Shield Can	2500004
	To-5 Insulator	2600001
	Battery Holder	2800001
	AA .5A/H Ni-Cad Unleaded	4000002
	4-40 1/4" Phillips Flat	2801003
	4-40 1" Phillips Flat	2801004
	4-40 1/4" Phillips Pan	2801005
	4-40 3/4" Phillips Pan	2801006
	7/16"-28 UNEF Hex Locknut	2802001
	Antenna, Telescoping	1200005

All unlisted resistors are ¼ watt, 5%, carbon film. Values are shown on the schematic.

PARTS LIST

Schematic Reference Number	Description	Ritron Part Number
C 101	Capacitor, 3.3 pF NPO	1501009
C 102	Capacitor, 8.2 pF NPO	1501014
C 104	Capacitor, 8.2 pF NPO	1501014
C 105	Capacitor, 150 pF N750	1501029
C 106	Capacitor, 150 pF N750	1501029
C 107	Capacitor, 10 pF NPO	1501015
C 108	Capacitor, 1.8 pF NPO	1501006
C 109	Capacitor, .001 uF Y5P	1501039
C 110	Capacitor, 180 pF N750	1501030
C 111	Capacitor, 1.5 pF	1501004
C 112	Capacitor, .001 uF Y5P	1501039
C 113	Capacitor, 100 uF 10V Electrolytic	1503010
C 114	Capacitor, 47 pF N150	1501023
C 115	Capacitor, 100 pF N750	1501027
C 116	Capacitor, .1 uF Y5P	1501059
C 117	Capacitor, .1 uF Y5P	1501059
C 118	Capacitor, 10 pF NPO	1501015
C 119	Capacitor, .001 uF MYLAR	1501040
C 120	Capacitor, .001 uF MYLAR	1501040
C 121	Capacitor, 1 uF 16 V Tantalum	1502007
C 122	Capacitor, 10 uF 16 V Electrolytic	1503006
C 123	Capacitor, .1 uF Y5P	1501059
C 124	Capacitor, .1 uF Y5P	1501059
C 125	Capacitor, 2.2 uF 25V Electrolytic	1503003
C 126	Capacitor, 220 uF 10V Electrolytic	1503011
C 127	Capacitor, .1 uF Y5P	1501059
C 128	Capacitor, 100 uF 10V Electrolytic	1503010
C 129	Capacitor, .001 uF Y5P	1501039
C 130	Capacitor, 22 pF NPO	1501019
C 131	Capacitor, 2-27 pF Film Trim Caps	1550003
C 132	Capacitor, 2-27 pF Film Trim Caps	1550003
C 133	Capacitor, 22 pF NPO	1501019
C 135	Capacitor, 68 pF N150	1501025
C 136	Capacitor, .001 uF Y5P	1501039
C 137	Capacitor, 1 pF P100	1501003
C 138	Capacitor, 12 pF NPO	1501016
C 139	Capacitor, .01 uF Y5P	1501049
C 140	Capacitor, .001 uF Y5P	1501039
C 141	Capacitor, .1 uF Y5P	1501059
C 142	Capacitor, .001 uF Y5P	1501039
C 201	Capacitor, 47 pF N150	1501023
C 202	Capacitor, 2-27 pF Film Trim Caps	1550003
C 203	Capacitor, 2-27 pF Film Trim Caps	1550003
C 204	Capacitor, 47 pF N150	1501023
C 205	Capacitor, 22 pF N150	1501019
C 206	Capacitor, .001 uF Y5P	1501039
C 207	Capacitor, 100 pF N750	1501027
C 208	Capacitor, 330 pF N750	1501033
C 209	Capacitor, 270 pF N750	1501030
C 210	Capacitor, 330 pF N750	1501033

PARTS LIST CONT.

Schematic Reference Number	Description	Ritron Part Number
C 211	Capacitor, 18 pF NPO	1501018
C 212	Capacitor, .68 pF P100	1501001
C 213	Capacitor, 33 pF NPO	1501021
C 214	Capacitor, 56 pF N150	1501024
C 215	Capacitor, 12 pF NPO	1501016
C 216	Capacitor, 1.2 pF P100	1501004
C 217	Capacitor, 12 pF NPO	1501016
C 218	Capacitor, 33 pF NPO	1501021
C 219	Capacitor, 5.6 pF NPO	1501012
C 220	Capacitor, 47 pF N150	1501023
C 221	Capacitor, 8.2 pF NPO	1501014
C 222	Capacitor, 18 pF NPO	1501018
C 223	Capacitor, .001 uF Y5P	1501039
C 224	Capacitor, .001 uF Y5P	1501039
C 225	Capacitor, 150 pF N750	1501029
C 226	Capacitor, 150 pF N750	1501029
C 227	Capacitor, .1 uF Y5P	1501059
C 228	Capacitor, .01 uF Y5P	1501049
C 229	Capacitor, 1 uF 16V Electrolytic	1503002
C 230	Capacitor, 150 pF N750	1501029
C 231	Capacitor, .33 uF 35V Tantalum	1502004
C 232	Capacitor, .0047 uF MYLAR	1501045
C 233	Capacitor, 150 pF N750	1501029
C 234	Capacitor, .01 uF MYLAR	1501050
C 235	Capacitor, 150 pF N750	1501029
C 236	Capacitor, .001 uF MYLAR	1501040
C 237	Capacitor, 100 pF N750	1501027
C 238	Capacitor, .001 uF MYLAR	1501040
C 239	Capacitor, 150 pF N750	1501029
C 240	Capacitor, 2.2 uF 25V Electrolytic	1503003
C 241	Capacitor, .001 uF Y5P	1501039
C 242	Capacitor, 150 pF N750	1501029
C 243	Capacitor, .001 uF MYLAR	1501027
C 301	Capacitor, .1 uF Y5P	1501059
C 302	Capacitor, .001 uF Y5P	1501039
C 303	Capacitor, 150 pF N750	1501029
L 100	Inductor, .47 UH ON 2.2K Resistor	1800120
L 101	Inductor, 1 UH	1800107
L 102	Inductor, 4.5T Spacewound Coil	1850004
L 103	Inductor, 4.5T Spacewound Coil	1850004
L 104	Inductor, 2.5T .1"ID LHH	1802002
L 105	Inductor, 3.5T Spacewound Coil	1850003
L 106	Inductor, 1 UH	1800107
L 107	Inductor, 4.5T Spacewound Coil	1850004
L 108	Inductor, 1 UH	1800107
L 201	Inductor, 1 UH	1800107
L 203	Inductor, 4.5T Spacewound Coil	1850004
L 204	Inductor, 6.5T Spacewound Coil	1850006
L 205	Inductor, 6.5T Spacewound Coil	1850006

PARTS LIST

Schematic Reference Number	Description	Ritron Part Number
B 301	Battery, .5 AH, 7.2V	4001001
C 101	Capacitor, .68 pFd P100 Disc	1501001
C 102	Capacitor, .5/3 pFd Tubular Trim	1550004
C 103	Capacitor, Wire	6000020
C 104	Capacitor, .5/3 pFd Tubular Trim	1550004
C 105	Capacitor, .68 pFd P100 Disc	1501001
C 106	Capacitor, 2.7 pFd NPO Disc	1501008
C 107	Capacitor, 18 pFd NPO Disc	1501018
C 108	Capacitor, .5/3 pFd Tubular Trim	1550004
C 109	Capacitor, Wire	6000020
C 110	Capacitor, .5/3 pFd Tubular Trim	1550004
C 111	Capacitor, .82 pF P100 Disc	1501002
C 112	Capacitor, 1.2 pFd P100 Disc	1501004
C 113	Capacitor, 10 mFd Elect; 16 VDC	1503006
C 114	Capacitor, .01 mFd Disc; 25 VDC	1501049
C 115	Capacitor, .001 mFd Disc; 50 VDC	1501039
C 116	Capacitor, 100 pFd N470 Disc	1501027
C 117	Capacitor, 47 pFd N150 Disc	1501023
C 118	Capacitor, .1 mFd Disc; 12 VDC	1501059
C 119	Capacitor, .1 mFd Disc; 12 VDC	1501059
C 120	Capacitor, 10 pFd NPO Disc	1501015
C 121	Capacitor, 33 pFd N150 Disc	1501021
C 122	Capacitor, .82 pFd; P100 Disc	1501002
C 123	Capacitor, 220 pFd N750 Disc	1501031
C 124	Capacitor, .01 mFd Disc; 25 VDC	1501049
C 125	Capacitor, .001 mFd Mylar Toothpick	1501040
C 126	Capacitor, .001 mFd Mylar Toothpick	1501040
C 127	Capacitor, 10 mFd Elect; 16 VDC	1503006
C 128	Capacitor, .1 mFd Disc; 12 VDC	1501059
C 129	Capacitor, .1 mFd Disc; 12 VDC	1501059
C 130	Capacitor, 2.2 mFd; 50 VDC	1503003
C 131	Capacitor, .1 mFd Disc; 12 VDC	1501059
C 132	Capacitor, 220 mFd Elect; 10 VDC	1503018
C 133	Capacitor, 150 pFd N750 Disc	1501029
C 134	Capacitor, 33 pFd N150 Disc	1501021
C 135	Capacitor, 47 pFd N150 Disc	1501023
C 136	Capacitor, 18 pFd NPO Disc	1501018
C 137	Capacitor, 10 pFd NPO Disc	1501015
C 138	Capacitor, .001 mFd Disc; 50 VDC	1501039
C 139	Capacitor, 8.2 pFd NPO Disc	1501014
C 140	Capacitor, 18 pFd NPO Disc	1501018
C 141	Capacitor, 180 pFd Ceramic Chip Cap	1504028
C 142	Capacitor, .68 pFd P100 Disc	1501001
C 143	Capacitor, 12 pFd NPO Disc	1501016
C 144	Capacitor, 5/27 pFd Polycarb Trimmer	1550003
C 145	Capacitor, 5/27 pFd Polycarb Trimmer	1550003
C 146	Capacitor, 12 pFd NPO Disc	1501016
C 147	Capacitor, .5/3 pFd Tubular Trim	1550004
C 148	Capacitor, 10 pFd NPO Disc	1501015

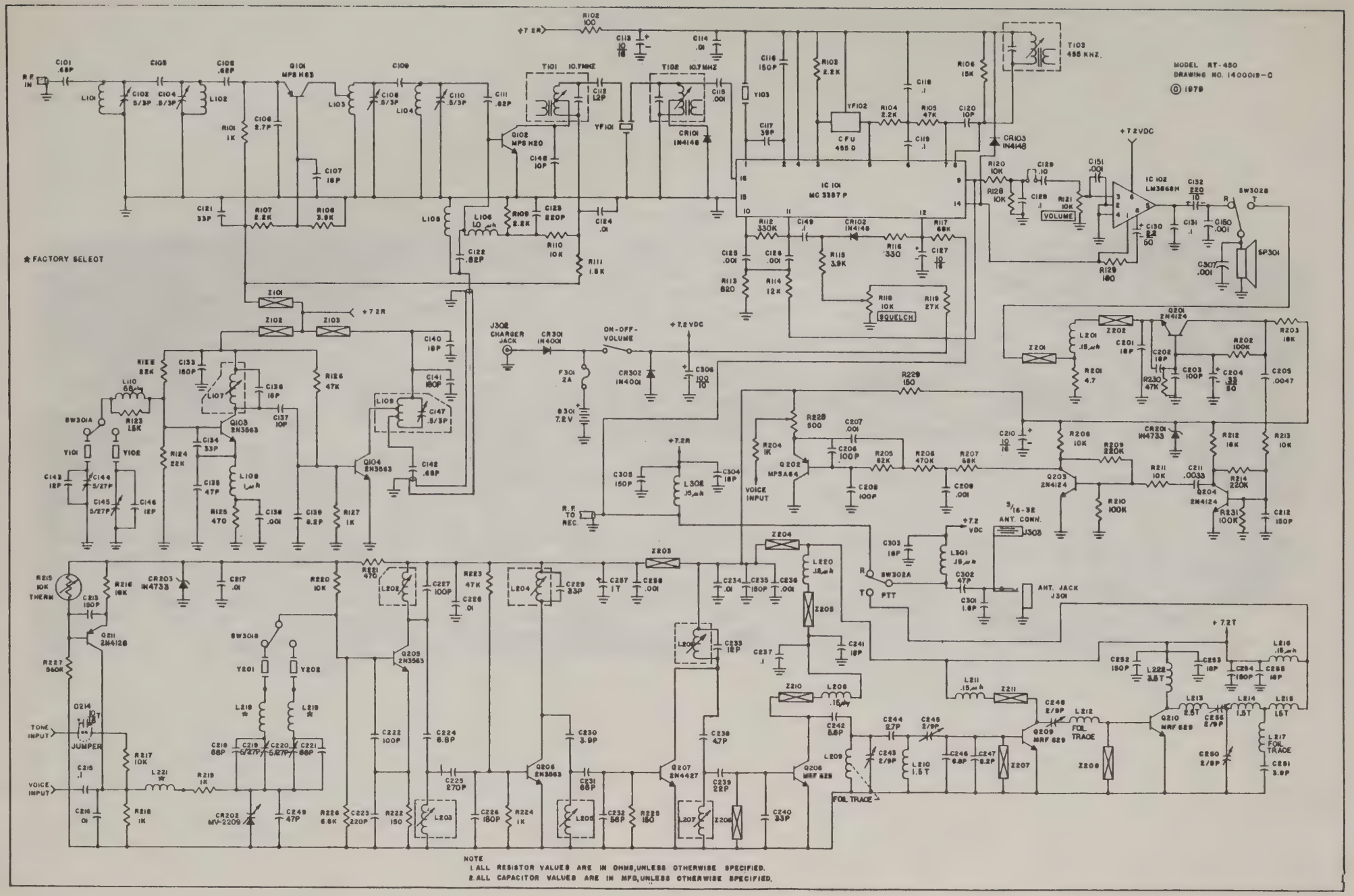
PARTS LIST CONT.

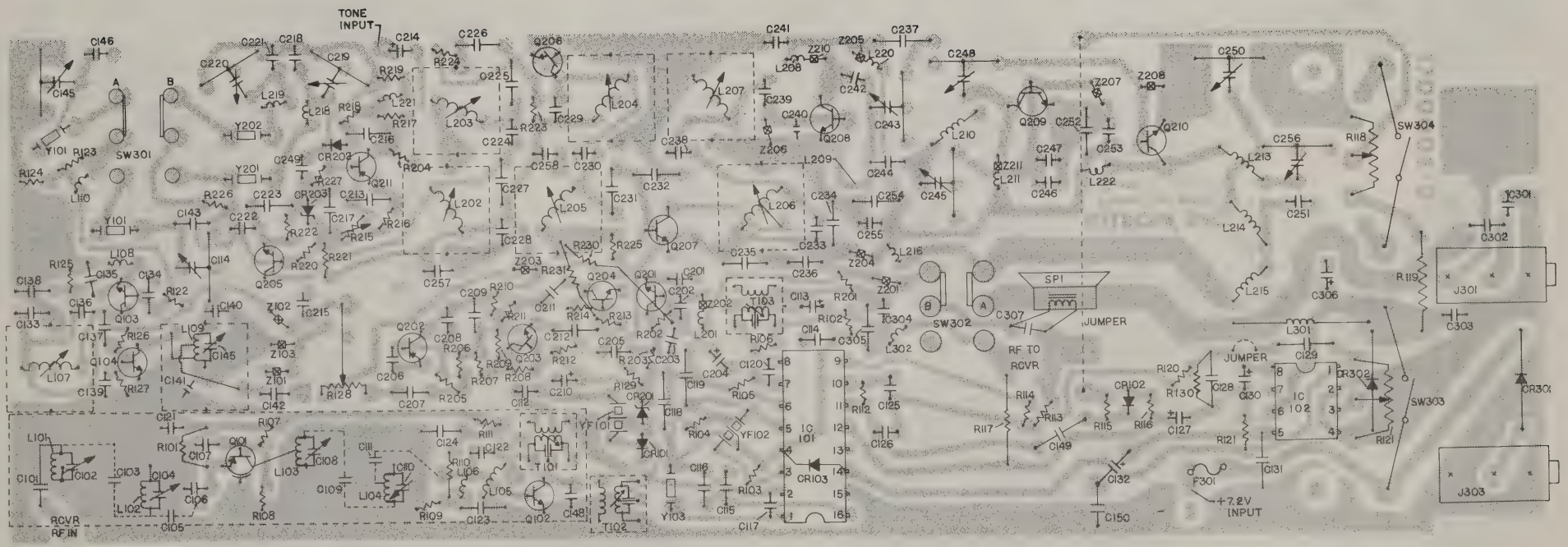
Schematic Reference Number	Description	Ritron Part Number
C 149	Capacitor, 1 mFd Disc; 12 VDC	1501059
C 150	Capacitor, .001 mFd Disc, 50 VDC	1501039
C 201	Capacitor, 18 pFd NPO Disc	1501018
C 202	Capacitor, 18 pFd NPO Disc	1501018
C 203	Capacitor, 100 pFd N470 Disc	1501027
C 204	Capacitor, .33 mFd Tantalum; 35 VDC	1502004
C 205	Capacitor, .0047 mFd Mylar Toothpick	1501045
C 206	Capacitor, 100 pFd N470 Disc	1501027
C 207	Capacitor, .001 mFd Mylar Toothpick	1501040
C 208	Capacitor, 100 pFd N470 Disc	1501027
C 209	Capacitor, .001 mFd Mylar Toothpick	1501040
C 210	Capacitor, 10 mFd Elect; 16 VDC	1503006
C 211	Capacitor, .0033 mFd Mylar Toothpick	1501043
C 212	Capacitor, 150 pFd N750 Disc	1501029
C 213	Capacitor, 150 pFd N750 Disc	1501029
C 214	Capacitor, 10 mFd; 16 VDC; Tant	1502013
C 215	Capacitor, .1 mFd Disc; 12 VDC	1501059
C 216	Capacitor, .01 mFd Disc; 25 VDC	1501049
C 217	Capacitor, .01 mFd Disc; 25 VDC	1501049
C 218	Capacitor, 68 pFd N150 Disc	1501025
C 219	Capacitor, 5/27 pFd Polycarb Trimmer	1550003
C 220	Capacitor, 5/27 pFd Polycarb Trimmer	1550003
C 221	Capacitor, 68 pFd N150 Disc	1501025
C 222	Capacitor, 100 pFd N470 Disc	1501027
C 223	Capacitor, 220 pFd N750 Disc	1501031
C 224	Capacitor, 6.8 pFd NPO Disc	1501013
C 225	Capacitor, 270 pFd N750 Disc	1501032
C 226	Capacitor, 180 pFd N750 Disc	1501030
C 227	Capacitor, 100 pFd N470 Disc	1501027
C 228	Capacitor, .01 mFd Disc; 25 VDC	1501049
C 229	Capacitor, 33 pFd N150 Disc	1501021
C 230	Capacitor, 3.9 pFd NPO Disc	1501010
C 231	Capacitor, 68 pFd N150 Disc	1501025
C 232	Capacitor, 56 pFd N150 Disc	1501024
C 233	Capacitor, 12 pFd NPO Disc	1501016
C 234	Capacitor, .01 mFd Disc; 25 VDC	1501049
C 235	Capacitor, 150 pFd N750 Disc	1501029
C 236	Capacitor, .001 mFd Disc; 50 VDC	1501039
C 237	Capacitor, .1 mFd Disc; 12 VDC	1501059
C 238	Capacitor, 4.7 pFd NPO Disc	1501011
C 239	Capacitor, 22 pFd N150 Disc	1501019
C 240	Capacitor, 33 pFd N150 Disc	1501021
C 241	Capacitor, 18 pFd NPO Disc	1501018
C 242	Capacitor, 5.6 pFd NPO Disc	1501012
C 243	Capacitor, 2/9 pFd Polyprop Trimmer	1550002
C 244	Capacitor, 2.7 pFd NPO Disc	1501008
C 245	Capacitor, 2/9 pFd Polyprop Trimmer	1550002
C 246	Capacitor, 6.8 pFd NPO Disc	1501013
C 247	Capacitor, 8.2 pFd NPO Disc	1501014
C 248	Capacitor, 2/9 pFd Polyprop Trimmer	1550002

Schematic Reference Number	Description	Ritron Part Number
R 115	Resistor, 4.7K, ¼W, 5%	4700141
R 116	Resistor, 330 ohm, ¼W, 5%	4700127
R 117	Resistor, 68K, ¼W, 5%	4700155
R 118	Resistor, 10K Control, Linear Taper	4750011
R 119	Resistor, 27K, ¼W, 5%	4700150
R 120	Resistor, 18K, ¼W, 5%	4700148
R 121	Resistor, 10K Control, Audio Taper	4750010
R 122	Resistor, 22K, ¼W, 5%	4700149
R 123	Resistor, 1.5K, ¼W, 5%	4700135
R 124	Resistor, 22K, ¼W, 5%	4700149
R 125	Resistor, 470 ohm, ¼W, 5%	4700129
R 126	Resistor, 47K, ¼W, 5%	4700153
R 127	Resistor, 1K, ¼W, 5%	4700133
R 128	Resistor, 5.6K, ¼W, 5%	4700142
R 129	Resistor, 180 ohm, ¼W, 5%	4700124
R 201	Resistor, 4.7 ohm, ¼W, 5%	4700104
R 202	Resistor, 100K, ¼W, 5%	4700157
R 203	Resistor, 18K, ¼W, 5%	4700148
R 204	Resistor, 1K, ¼W, 5%	4700133
R 205	Resistor, 82K, ¼W, 5%	4700156
R 206	Resistor, 470K, ¼W, 5%	4700165
R 207	Resistor, 68K, ¼W, 5%	4700155
R 208	Resistor, 10K, ¼W, 5%	4700145
R 209	Resistor, 220K, ¼W, 5%	4700161
R 210	Resistor, 100K, ¼W, 5%	4700157
R 211	Resistor, 10K, ¼W, 5%	4700145
R 212	Resistor, 18K, ¼W, 5%	4700148
R 213	Resistor, 10K, ¼W, 5%	4700145
R 214	Resistor, 220K, ¼W, 5%	4700161
R 215	Resistor, 10K Thermistor, 0.1 x 0.1	4750100
R 216	Resistor, 18K, ¼W, 5%	4700148
R 217	Resistor, Factory Selected	4700999
R 218	Resistor, 1K, ¼W, 5%	4700133
R 219	Resistor, 1K, ¼W, 5%	4700133
R 220	Resistor, 10K, ¼W, 5%	4700145
R 221	Resistor, 470 ohm, ¼W, 5%	4700129
R 222	Resistor, 150 ohm, ¼W, 5%	4700123
R 223	Resistor, 47K, ¼W, 5%	4700153
R 224	Resistor, 1K, ¼W, 5%	4700133
R 225	Resistor, 150 ohm, ¼W, 5%	4700123
R 226	Resistor, 6.8K, ¼W, 5%	4700143
R 227	Resistor, 560K, ¼W, 5%	4700166
R 228	Resistor, 500 ohm Linear Trimmer	4750001
R 229	Resistor, 150 ohm, ¼W, 5%	4700123
R 230	Resistor, 47K, ¼W, 5%	4700153
R 231	Resistor, 100K, ¼W, 5%	4700157
T 101	Transformer, 10.7 MHz	5600001
T 102	Transformer, 10.7 MHz	5600001
T 103	Transformer, 455 KHz	4600002

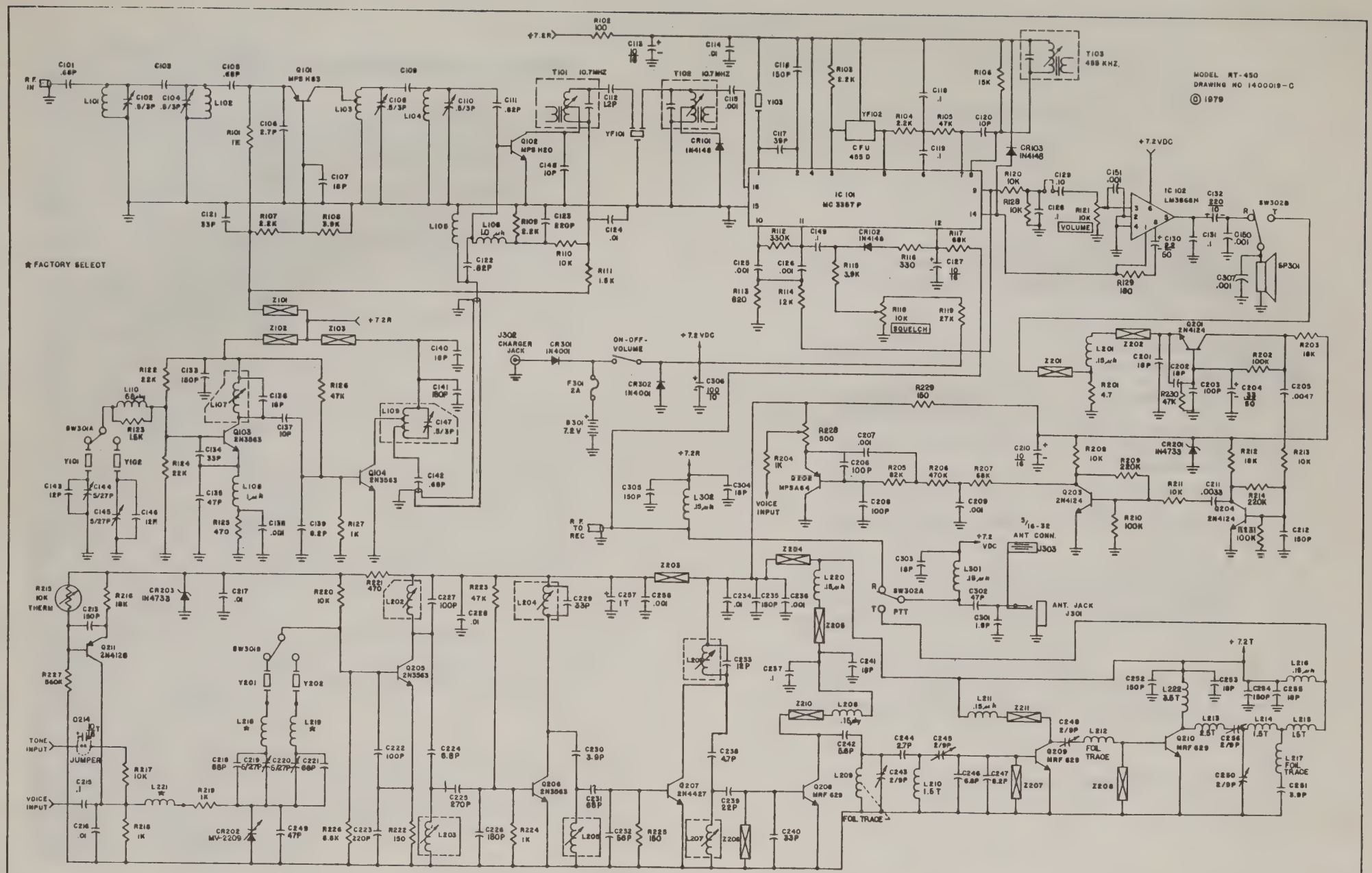
PARTS LIST CONT.

Schematic Reference Number	Description	Ritron Part Number
Y 101	Crystal, Receive	2300002
Y 102	Crystal, Receive	2300002
Y 103	Crystal, 2nd LO	2300005
Y 201	Crystal, Xmit	2300001
Y 202	Crystal, Xmit	2300001
YF 101	Crystal Filter, 10.7 MHz	2301001
YF 102	Ceramic Filter, CFU-455D	2301002
Z 101	Ferrite Bead	1801003
Z 102	Ferrite Bead	1801003
Z 103	Ferrite Bead	1801003
Z 201	Ferrite Bead	1801003
Z 202	Ferrite Bead	1801003
Z 203	Ferrite Bead	1801003
Z 204	Ferrite Bead	1801003
Z 205	Ferrite Bead	1801003
Z 206	Ferrite Bead	1801003
Z 207	Ferrite Bead	1801003
Z 208	Ferrite Bead	1801003
Z 210	Ferrite Bead	1801003
Z 211	Ferrite Bead	1801003
	Antenna, UHF Rubber Duck	1200003
	Nameplate, Front	1400016
	Trim Strips, .31 x 7.5	1400017
	FCC Label	1400018
	Handheld Case Assembly	1400032
	Battery Connector	2100002
	10MM Shield Can	2500003
	Shield, RF Amplifier	2500005
	Shield, Partition Wall	2500006
	Spring Strip Ant Conn	2500008
	TO-5 Insulator Thermalloy	2600001
	4-40 x 1/4, Phil, FHMS	2801003
	4-40 x 1, Phil, FHMS	4801004
	4-40 x 1/4, Phil, PHMS	2801005
	4-40 x 3/4, Phil, PHMS	2801006
	Nut, 7/16 x 28 UNEF, HEX	2802001
	6" RG-178B/U 50 ohm Coax	6001001
SW 301	Switch, Channel, DPDT	5100002
SW 302	Switch, PTT, DPDT	5100001
SP 301	Speaker, 2" Round, 8 ohm	5500001


MODEL RT-450
DRAWING NO. 14000R8-C
© 1979
★FACTORY SELECT
IC 101 MC 3357 P
IC 102 LM386BM
CFU 455 D
SQUELCH
VOLUME
ON-OFF-VOLUME
J302 CHARGER JACK
CR301 IN4001
CR302 IN4001
F301 2A
B301 7.2 V
+7.2VDC
+7.2R
+7.2
+7.2T
VOICE INPUT
R.F. TO REC.
5/16-32 ANT. CONN.
J303
ANT. JACK J301
PTT
SW302A
SW302B
SW301A
SW301B
TONE INPUT
VOICE INPUT
JUMPER
FOIL TRACE
SP301
THERM
MV-2209
NOTE
1. ALL RESISTOR VALUES ARE IN OHMS, UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITOR VALUES ARE IN MFD, UNLESS OTHERWISE SPECIFIED.



RT-450 BOTTOM SIDE


MODEL RT-450
DRAWING NO 1400019-C
© 1979
★FACTORY SELECT
IC 101 MC 3367 P
IC 102 LM386M
CFU 455 D
VOLUME
SQUELCH
ON-OFF-VOLUME
CHARGER JACK
VOICE INPUT
TONE INPUT
JUMPER
PTT
ANT. JACK J301
ANT CONN. J303
FOIL TRACE
SP301
+7.2VDC
+7.2R
+7.2T
R.F. IN
R.F. TO REC
NOTE
1. ALL RESISTOR VALUES ARE IN OHMS, UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITOR VALUES ARE IN MFD, UNLESS OTHERWISE SPECIFIED.

Transmitter Tone (Yellow, RTS-1JR)
Modulation Input (White, RME-3)
R217 @ 68K For RME-3 & RTS-1JR
Ground, Typical (Black)
Receiver Output Signal (Green, RTS-1JR)
Receiver Squelch Point (White, RTS-1JR)
B+ 7.2 VDC (Red)
Jumper (Add)
"Hang Up" Signal (Violet, RTS-1JR)

RT-450 TONE INSTALLATION DRAWING

SUB-AUDIBLE TONE INSTALLATION

A Tone Installation drawing is shown on the reverse side of this sheet for RITRON, INC. tone boards RME-3 (Encode only) and RTS-1JR (Encode and Decode).

Other brands and types of tone encoding and decoding circuits may be interfaced with the radio if desired. Following are the recommended points for attaching such circuits:

Receiver Output Signal:	Junction of R120, R128, C128 & C129
B+ Voltage (7.2 VDC):	Output of ON/OFF Switch
Ground:	Any convenient Ground track
Receiver Squelch Point:	Pin 14 of IC101 (Ground to Squelch Receiver)
Transmitter Tone Modulation Input:	Input to R217 or C214 (R217 is selected to produce proper amount of modulation)
"Hang-Up" Signal:	SPST Switch on Squelch Control

These 6 points are shown on the reverse side of this sheet as part of the Installation Drawing.

RT-450 Transmitter Voltages

DC Voltage Chart with:

Channel Selector in dead spot between channels
(EXCEPT for * tests with Detector when channel selector must be set to an installed channel)

PTT Switch in Transmit position

+7.2 VDC Battery or equivalent supply voltage

All Voltages measured with 10 megohm VTVM
(EXCEPT for * tests with Detector which must use 20K/V VOM on 10 VDC scale.)

Device	Pin	VDC	Device	Pin	VDC
Q201	B	0.6	Q207	B*	4.5
	E	0		E	0
	C	1.8		C	7.2
Q202	B	2.4	Q208	B*	6.0
	E	3.7		E	0
	C	0		C	7.2
Q203	B	0.6	Q209	B	0
	E	0		E	0
	C	2.2		C	7.2
Q204	B	0.6	Q210	B	0
	E	0		E	0
	C	2.1		C	7.2
Q205	B	1.8	Q211	B	5.1
	E	1.0		E	5.1
	C	7.2		C	0
Q206	B*	3.0			
	E	0			
	C	7.2			

*NOTE: Tests marked with * are measured with the Detector shown under "Test Equipment Required" and a 20 K/V VOM on the 10 VDC scale. These voltages are only approximate and may vary by 40% from that shown. CHANNEL SELECTOR MUST BE SET ON AN INSTALLED CHANNEL FOR * TESTS.

RT-450 Receiver Voltages

DC Voltage Chart with:

Receiver Unsquelched
Volume at Minimum
Channel Selector on dead spot between channels
No Signal Input
PTT Switch in Receive position
+7.2 VDC Battery or equivalent supply voltage
All Voltages measured with 10 megohm VTVM

Device	Pin	VDC	Device	Pin	VDC
Q101	B	4.7	IC101	5	1.0
	E	5.5		6	1.0
	C	0		7	1.0
				8	6.9
Q102	B	0.7		9	3.0
	E	0		10	2.0
	C	4.2		11	2.2
				12	1.2
Q103	B	3.2		13	0
	E	2.5		14	1.2
	C	7.2		15	0
Q104	B	0.15		16	2.0
	E	0	IC102	1	1.2
	C	7.2		2	0
IC101	1	6.9		3	0
	2	6.3		4	0
	3	6.9		5	3.5
	4	6.9		6	7.2
				7	3.6
				8	1.2

RECEIVER ALIGNMENT

1. IF Sweep Alignment

   NOTE: This adjustment should not be required in the field except when T101, T102, YF101, or IC101 is replaced.

   1. Through a DC blocking capacitor (.001 mfd ceramic disc) inject a signal swept 25 kHz about 10.7 mhZ at the base of Q102.

   2. Connect an Oscilloscope thru a High Impedance RF Detector to pin 16 of IC101.

   3. IF REQUIRED, adjust T101 and T102 to provide a pass-band of 15 kHz centered on 10.7 mHz. Be sure to lower the input signal level to a point where the clamp diode (CR101) is not limiting.

   4. Remove the detector from pin 16 of IC101.

   5. Through the blocking capacitor in 1 above, inject a 10.7 mHz signal modulated 3 kHz by a 1 kHz sinewave.

   6. Adjust T103 for maximum audio on R121 or maximum output from the speaker.

   7. Remove the 10.7 mHz signal and DC blocking capacitor.

2. 1st Local Oscillator Adjustment

   1. Install the receive crystal in the desired channel position.

   2. Connect, to the antenna jack, a signal on the receive frequency modulated 3 kHz by a 1 kHz sine wave. Adjust the associated receive crystal trimming capacitor C144 or C146 and L107 and C147 for best SINAD at R121 or at the speaker.

3. Filter and RF Amplifier

   1. Use the set-up described in 2-1 above.

   2. Adjust C102, C104, C108, and C110 for best SINAD or quieting at R121 or at the speaker.

   3. Decrease the signal input and repeat 3-2 above until maximum sensitivity is achieved.

   4. Readjust C147 for best sensitivity.

TRANSMITTER ALIGNMENT

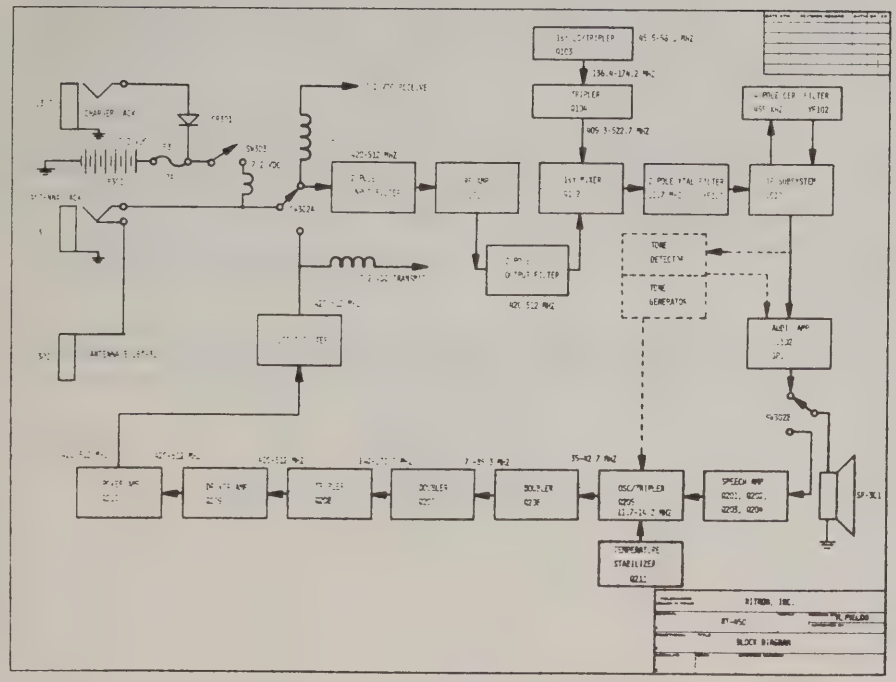
NOTE: The following adjustments may all be made from either the top or the bottom of the board. Key the transmitter by depressing the Push-To-Talk switch for each measurement.

1. Install a transmit crystal in the desired channel position.
2. Connect the wattmeter to the antenna jack.
3. Set R128 fully CCW. (No modulation)
4. Using an RF voltage probe or RF Detector (see under Test Equipment Required) on the base of Q206, adjust L202 and L203 for a maximum reading.
5. Move the RF probe to the base of Q207 and adjust L204 and L205 for a maximum reading.
6. Move the probe to the base of Q208 and adjust L207 and L206 for a maximum reading.
7. Move the probe to the base of Q209 and adjust C243 and C245 for a maximum reading.
8. Adjust C248, C256 and C250 for a maximum reading on the wattmeter.
9. Readjust all the above controls for a maximum reading on the wattmeter.
10. Adjust the associated trimmer capacitor (C219 or C220) to the correct transmit frequency.
11. Adjust R128 for 5 kHz maximum deviation. (NOTE: If subaudible tone is installed, the deviation must be adjusted for 5 kHz maximum with tone applied).

L202, C227, L203, C225, and C226 select the 3rd harmonic of the crystal frequency from the collector of Q205 and match it into the base of Q206, a doubler. L204, C229 and L205, C231, C232 are coupled by C224 and are tuned to the 6th harmonic of the crystal frequency. This signal is applied to the base of Q207, another doubler. Two coupled resonant circuits L207, C233 and L206, C239, C240 coupled by C238 are tuned to the 12th harmonic of the crystal frequency. This signal is applied to the base of a power tripler (Q208).

The output of Q208 is tuned to the 36th harmonic of the crystal frequency and covers the range from 420 to 512 mHz. Two coupled resonant circuits, C242, L209, C243 and L210, C245, C246, C247 coupled by C244, are used to transfer this energy to the base of Q209 the Driver Amplifier. The output of Q209 is coupled to the Power Amplifier (Q210) by a matching network C248 and L212.

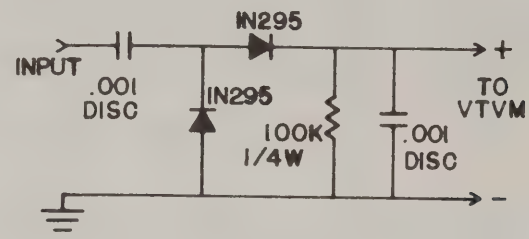
The output of Q210 is matched to 50 ohms by L213, C256, and C250. The elliptic function output filter consisting of L214, L217, C251, and L215 reduces the levels of the spurious outputs to below the FCC limits and couples the power output to the Antenna Jack (J301) or the Antenna Socket (J302) through the TR switch SW302A.



RT-450 TUNE UP PROCEDURE

TEST EQUIPMENT REQUIRED:

1. 0 to 10 Volt DC, 1 Amp, Current Limited Supply
2. RF Wattmeter, 3 to 5 watts full scale.
3. RF Signal Generator (To 512 mHz)
4. Deviation Meter
5. Frequency Counter (To 512 mHz)
6. VTVM or DMM
7. RF Voltmeter (To 512 mHz) or RF Detector (see below)
8. Sweep Generator (For 10.7 mHz IF Alignment)
9. Oscilloscope



RF Detector

RADIO PREPARATION:

1. Open unit by removing the two #4 screws from the backplate.
2. Disconnect and remove the battery pack.
3. Connect the unit to an 8 VDC, 1 Amp current limited power supply through the charger jack on the top of the unit.

THEORY OF OPERATION MODEL RT-450

RECEIVER

The RT-450 incorporates a 2 channel crystal-controlled, dual conversion, superheterodyne FM receiver. Power is supplied by 6 "AA" nickel-cadmium cells connected in series.

RECEIVER RF-IF-DETECTOR-AUDIO

A signal applied to the Antenna Jack (J301) passes through the Antenna Switch (SW302A) to a 2-Pole, bandpass, helical resonator filter (L101, C102, L102, & C104). From this filter, the signal goes to a common base RF Amplifier (Q101). A second two section filter (L103, C108, L104, & C110) couples the signal to the First Mixer (Q102).

The First Local Oscillator (Q103) is a crystal controlled Clapp type with the collector output tuned to the third harmonic of the crystal oscillation frequency. The collector output signal is fed to the First LO Tripler (Q104). The output frequency of this stage is 9 times the crystal frequency. This signal is also fed to the First Mixer (Q102).

The output of the First Mixer is a 10.7 MHz signal which is filtered by a two-pole monolythic filter YF101. Matching transformers (T101 and T102) couple the signal in and out of the crystal filter. The signal level out of T102 is limited to approximately 1 volt RMS by a clamp diode CR101. This signal is then coupled to the Receiver Subsystem (IC101).

The Receiver Subsystem (IC101) is a multifunction FM-IF integrated circuit. The 10.7 MHz IF signal is applied to pin 16 of IC101 which is the input of a balanced mixer. The 2nd LO Crystal (Y103) is driven by IC101 pins 1 and 2. The LO signal also drives the balanced mixer which provides a 455 kHz 2nd IF signal at pin 3. A 455 kHz, 4 pole ceramic filter (YF102) is placed between the 2nd mixer output (pin 3 of IC101) and the input to the limiting IF amplifier (pin 5 of IC101).

The output of the limiter (pin 7) drives a multiplier, both internally and through a quadrature coil, (T103) to detect FM. The recovered audio present at pin 9 is de-emphasised by R120 and C128, attenuated by the volume control (R121) and applied to IC102, a .35 watt audio amplifier with a gain of 50. The audio output is connected through C132 to the 8 ohm speaker, SP301.

SQUELCH CIRCUIT

An 8 kHz bandpass filter is built around an on-chip, inverting, operational amplifier, (pins 10 and 11 of IC101). This circuit amplifies 8 kHz noise which is applied to a biased noise detector (CR102). The output of CR102 is connected to a Schmidt trigger (pins 12 and 14 of IC101). Pin 14 is grounded in the presence of noise and goes high when no noise is applied to CR102. An on-channel carrier therefore causes pin 14 to be high and allows IC102 to function as an audio amplifier. When noise is present at CR102, the output of the Schmidt trigger is low, which mutes the audio amplifier. R118, the Squelch Control, sets the threshold of squelch action.

TRANSMIT/RECEIVE PUSH-TO-TALK SWITCH

In receive, the speaker is connected to the output of the audio amplifier through the Transmit/Receive Push-To-Talk Switch (SW302B). The receiver input is connected to the antenna through SW302A. SW302A also applies battery voltage, isolated with chokes, to the receive circuitry. In transmit, the speaker is used as a microphone and it's output is applied to the input of the speech amplifier. The transmitter output and the transmitter +7.2 VDC is switched to the combined antenna and choke fed +7.2 VDC distribution bus. The transmitter speech amplifier limiter and low pass filter, (Q201, Q204, Q203 and Q202 and associated components) limit the amplitude and frequency components of the voice signal prior to application to the modulator. R128 is used to set the maximum voice modulation deviation. Q201 and Q204 amplify the signal from SP301 and provide pre-emphasis prior to limiting in Q203. Q202 and associated circuitry provide a -18 dB/octave characteristic for frequencies above 3 kHz.

The transmitter frequency is controlled by a crystal oscillator Q201. CR202 acts as a voltage variable capacitance modulator to vary the frequency of the crystal oscillator. Variable capacitors (C219 and C220) are included for setting the transmitter to the correct frequency.

The temperature compensation circuitry to maintain the frequency of the transmitter within $\pm$.0005% over the range of -30°C to +50°C consists of Q211 and associated parts R215 (a 10K Thermistor), R227, R216, and R218. The ambient temperature within the RT-450 case is sensed by R215 which is used in a voltage divider circuit with R227. When the temperature reaches approximately -5°C, the voltage across R215 becomes sufficient to begin turning on Q204. The resulting current through Q204 flows through R218 which develops a small reverse bias voltage on the varactor diode CR202. This voltage causes CR202 to change reactance slightly which moves the frequency of the crystal oscillator to compensate for the natural drop in frequency of the quartz crystals below 0°C.

RT-450 OPERATING INSTRUCTIONS

The RT-450 is a two-way radio operating in the UHF-FM communications band. This radio has the capability of transmitting and receiving frequencies assigned to you by the FCC and must be licensed before use.

This unit is equipped with a flexible spiral antenna. Always have it installed in the threaded antenna mount before using the radio.

The internal battery pack may have become discharged during shipment. It is recommended that the charger cube, included with the radio, be plugged into the unit for at least 8 hours to bring the batteries to a partial charge before first using the transceiver.

The On/Off control for the radio is incorporated with the volume adjustment control. Turn this knob clock-wise to turn the unit on. Further rotation will increase the volume of a received signal.

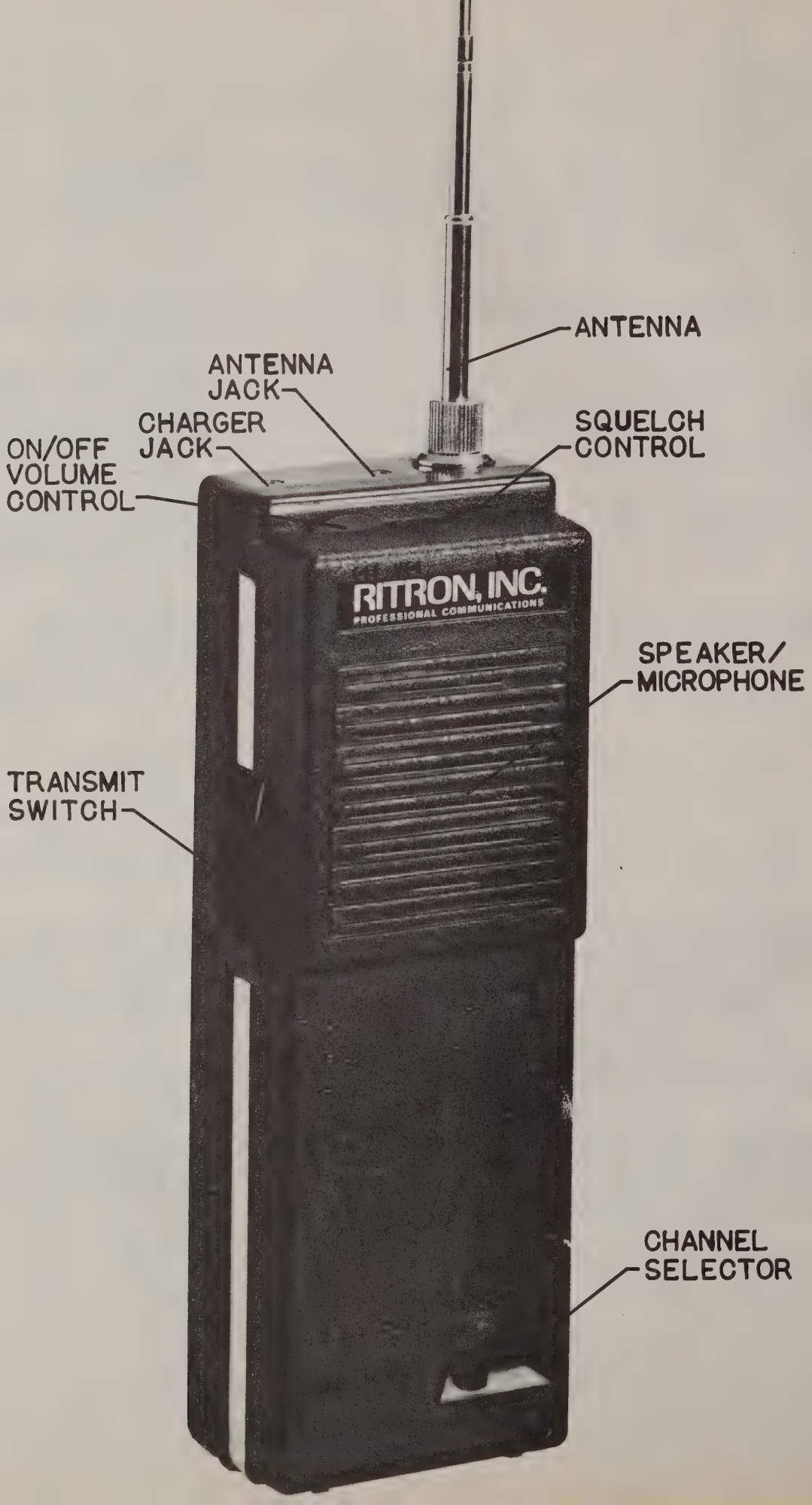
The squelch control can be set by the user to eliminate the static between transmissions. Rotate the squelch control counter-clockwise until noise is heard and then set the squelch by rotating the control clockwise until the noise is eliminated.

If the radio is equipped with a CTCSS (sub-audible) tone squelch system, it may be activated by turning the squelch control fully counter-clockwise. The tone squelch circuit is activated only by transmissions using the tone squelch code installed in the unit. If you have tone squelch, always turn it off and monitor the channel before transmitting to avoid interference with other users of your channel.

To talk to other stations simply push the transmit switch on the side of the case and hold it down while speaking into the grill at the top front of the case. Hold the radio about 2 inches from your lips and speak in a normal tone. Release the transmit switch to hear a reply.

The channel selector allows you to select either of two frequencies that can be installed.

When the radio's batteries are discharged, turn the unit off, plug the charger into the charging jack at the top left of the case, plug the charger into a 110 VAC wall outlet and allow the batteries 12-14 hours to fully charge.


ANTENNA
ANTENNA JACK
CHARGER JACK
ON/OFF VOLUME CONTROL
SQUELCH CONTROL
RITRON, INC.
PROFESSIONAL COMMUNICATIONS
SPEAKER/ MICROPHONE
TRANSMIT SWITCH
CHANNEL SELECTOR

PERFORMANCE SPECIFICATIONS

GENERAL

Frequency Range:	450 to 512 MHz
Power Supply:	6 "AA" Nickel-Cadmium
Battery Drain:	Standby 25mA Receive 63mA Transmit 750mA
Battery Life: (5% Transmit, 5% Receive, 90% Standby)	8 hours/charge
Dimensions:	Height 7.21 inches(excluding antenna) Width 2.58 inches Depth 1.82 inches
Weight:	1 pound
FCC Model Number:	RT-450

RECEIVER SPECIFICATIONS

Audio Output:	350 mW at less than 10% distortion
Frequency Stability:	± .001% from -30 to +50 degrees C
Modulation Acceptance:	± 7.5 kHz Maximum
Spurious Rejection:	Greater than 55 dB
Image Rejection:	Greater than 40 dB
Selectivity:	More than 55 dB at 25 kHz
Intermodulation:	More than 60 dB
Sensitivity:	.50 uV for 12 dB sinad max
Noise Squelch Sensitivity:	.20 uV to .80 uV adjustable
Maximum Channel Separation:	3 MHz with no degradation
Crystal Specification:	(Receive Frequency - 10.7 MHz) /9 Third Overtone, Parallel Mode, 32 pF RITRON Specification No. 2300002

PERFORMANCE SPECIFICATIONS (cont)

TRANSMITTER SPECIFICATIONS

RF Output:	1.0 Watt
Frequency Stability:	± .0005% from -30 to +50 degrees C
Modulation:	Type 16F3, ± 5 kHz for 100% modulation at 1000 Hz
Spurious and Harmonics:	More than 45 dB below 1 Watt
Maximum Channel Separation:	5.5 MHz
Crystal Specifications:	Transmit Frequency /36 Fundamental mode, 32 pF Static Capacitance = 6-7 pF RITRON Specification No. 2300001

Handheld Transceivers
For Professionals

RITRON, INC.

MAINTENANCE AND OPERATING MANUAL MODEL RT-450
UHF-FM HANDHELD TRANSCEIVER

LIMITED 90 DAY WARRANTY

To the original consumer purchaser only, Ritron, Inc. warrants this product and its components and parts to be free from defects in materials and/or workmanship for a period of 90 days from the date of purchase. If the product malfunctions within 90 days from the date of purchase as a result of any defect in materials and/or workmanship and is sent at the sender's expense and received by Ritron, Inc. ("Attention Warranty Department") at 148 West Carmel Drive, Carmel, Indiana 46032 within 110 days of the date of purchase, then Ritron, Inc. will restore the product to proper operating condition without additional charge to the original consumer purchaser by either repairing or replacing the product, its components or parts. ANY AND ALL TECHNICAL INFORMATION PROVIDED WITH THIS OR ANY OTHER RITRON, INC. PRODUCT IS EXPRESSLY EXCLUDED FROM THIS WARRANTY.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

Not Responsible for All Malfunctions

Ritron, Inc. shall have no responsibility if this product malfunctions as a result of anything other than a defect in materials and/or workmanship. For example, we shall not be responsible if the product malfunctions as a result of accident, abuse or misuse of the product. As a further example, if the product is used with a non-Ritron, Inc. supplied or approved product or accessory or if you permit our product to be repaired, modified or installed by anyone other than a Ritron, Inc. authorized service dealer, then we shall have no responsibility in the event the product malfunctions if the defect or damage causing the malfunction results from such unauthorized or unapproved use, repair, modification or installation.

Exclusive Express Warranty

This warranty is the only express warranty made by Ritron, Inc. relating to this product. No person is authorized to make any other warranty on behalf of Ritron, Inc. with respect to this product and no representation made by any person about this product is included in this warranty.

Duration of Implied Warranty

THE DURATION OF ANY AND ALL IMPLIED WARRANTIES APPLICABLE TO THIS PRODUCT, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, SHALL BE THE SAME 90-DAY PERIOD AS FOR THIS EXPRESS WARRANTY. (Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.)

Limitation of Actions

Any law suit for breach of warranty, whether express or implied, with respect to this product, must be commenced within one year and 90 days after its original purchase by a consumer or be permanently barred.

Not Responsible For Consequential Damages

Ritron, Inc. shall have NO RESPONSIBILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUSINESS LOSS, PROPERTY DAMAGE OR PERSONAL INJURY, FOR BREACH OF THIS WARRANTY OR ANY IMPLIED WARRANTY in connection with any malfunction of this product. The sole remedy for any such breach is that established in the first paragraph of this Limited 90 Day Warranty. (Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.)

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SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

148 West Carmel Drive • Carmel, Indiana 46032 • 317-846-1201

MARK REVIS

MOTOROLA

"EXPO" SERIES

"Handie-Talkie" Portable Radios

406-420 MHz
450-512 MHz

SPECIFICATIONS

GENERAL

FREQUENCY RANGE: 406-420MHz, 450-512MHz

POWER SUPPLY: (1) Nickel-cadmium or (1) Mercury battery

BATTERY DRAIN* at 7.5Vdc

Standby:	9.5mA
Receive:	78mA
Transmit:	520mA

DIMENSIONS

Height	5.34 in. (135.6mm)
Width:	2.56 in. (65mm)
Depth:	1.00 in. (25.4mm)

WEIGHT*

with 250mA nickel-cadmium battery:	12.5 oz. (354.4g)
with 500mA nickel-cadmium battery:	14.1 oz. (399.7g)
with mercury battery:	15.2 oz. (430.9g)

*For "Private-Line" models, add 0.7 oz (20g) to weight and 3mA to drain.

TRANSMITTER

RF OUTPUT

Nickel-cadmium battery:	1.0W at 7.5Vdc
Mercury battery:	0.7W at 6.9Vdc

FREQUENCY STABILITY: ±0.0005% from −30°C to +60°C (+25°C ref.)

MODULATION: Type 16F3, ±5kHz for 100% modulation at 1000Hz

SPURIOUS & HARMONIC FREQUENCIES: More than 46dB below carrier

FM NOISE: At least 50dB below ±3.0kHz deviation at 1000Hz

AUDIO RESPONSE: +1, −3dB from 6dB octave pre-emphasis characteristic from 300-3000Hz

AUDIO DISTORTION: Less than 5% at 1000Hz, 3kHz deviation

MAX. PERMISSIBLE CHANNEL SEPARATION: 20MHz (no degradation)

RECEIVER

AUDIO OUTPUT: Full volume measured at 12". From 300-3000Hz average SPL is 90dB. EIA distortion less than 5%.

FREQUENCY STABILITY: ±0.0010% from −30°C to +60°C (+25°C ref.)

USABLE BANDWIDTH: ±5.0kHz

SPURIOUS & IMAGE FREQUENCY REJECTION: More than 55dB below carrier

SENSITIVITY: 0.35uV max. (12dB SINAD), 0.5uV max. (20dB quieting)

SELECTIVITY: More than 70dB at ±25kHz (12dB SINAD)

NOISE SQUELCH SENSITIVITY: Noise compensated type, fixed, internal, with external push-to-defeat on volume control

MAX. PERMISSIBLE CHANNEL SEPARATION: 3MHz (no degradation)

INTERMODULATION: More than 65dB at adjacent channel

CHANNEL SPACING: 25kHz

Specifications Subject To Change Without Notice

RADIO MODELS

MODEL NUMBER (Submersible)	MODEL NUMBER (Standard)	NUMBER OF CHANNELS	TYPE OF SQUELCH
H24SPB1110AN	H24XPB1110AN	1	Carrier
H24SPB1120AN	H24XPB1120AN	2	Carrier
H24SPB3110AN	H24XPB3110AN	1	Tone "Private-Line"
H24SPB3120AN	H24XPB3120AN	2	Tone "Private-Line"
H24SPB6110AN	H24XPB6110AN	1	"Digital Private-Line"
H24SPB6120AN	H24XPB6120AN	2	"Digital Private-Line"

RELATED PUBLICATIONS AVAILABLE SEPARATELY

Operating Instructions	68P81025C15
Theory/Maintenance Manual	68P81025C35

Service Manual
68P81025C20-A

RECEIVER ALIGNMENT

Preliminary Adjustments:

1. Set squelch control R201 to its maximum counterclockwise position.
2. Set frequency switch S204 to the lowest frequency channel.
3. Set cores of Z1, Z2, Z3, Z4, and Z5 flush with the solder side of the circuit board.
4. Set cores of L5 and L6 flush with the solder side of the circuit board.

NOTE: If a frequency counter and a SINAD meter are available, perform the Preferred Method of Alignment (steps 1, 2, 3, and 4); otherwise perform the Alternate Method of Alignment (steps 1A, 2, 3, and 4A).

STEP	ADJUST	FOR	MEASURED AT	USING	NOTE
1	First oscillator frequency	Correct conversion of second i-f frequency	Pin 14 of U3 (TP2)	Signal Generator, AC Voltmeter, Frequency Counter	Determine second i-f frequency as follows: 1. Connect ac voltmeter to pin 14 of U3 and a frequency counter to the output of the ac voltmeter. 2. Adjust the signal generator to the carrier frequency and inject a – 60dBm signal into antenna jack J201. 3. Adjust the range on the ac voltmeter to peg the needle for full-scale deflection. This is necessary to drive the frequency counter in the following step. 4. Adjust the warp coil for the selected radio channel (L5 for F1 & L6 for F2) until a frequency of 455kHz ± 1.5kHz is obtained.
1A ALTERNATE METHOD	First oscillator frequency	Correct conversion of second i-f frequency	Speaker Jack J202	Signal Generator, AC Voltmeter, AC Voltmeter Tune-Up Cable	1. Adjust volume control R201 for 1.1Vrms noise level. 2. Increase the signal generator output until noise level begins to decrease, less than 1.1Vrms. 3. Adjust the warp coil for the selected channel (L5 for F1 & L6 for F2) for a minimum noise level. Readjustment of the signal generator may be necessary.
2	L4	Noise balance	Pin 18 of U3 (TP3)	Oscilloscope	Adjust the oscilloscope so the trace is centered with the vertical mode in ac position. Adjust L4 until the noise at pin 18 of U3 is equally distributed around the center line.
3	Z4, Z5	Minimum dc voltage	Pin 5 of U2 (TP1)	DC Voltmeter	1. Connect a dc voltmeter to pin 5 of U2. 2. Adjust Z4 and Z5 for a minimum dc voltage reading at TP1. Repeat if necessary.
4	Z1, Z2, Z3	Maximum SINAD	Speaker Jack J202	Signal Generator, AC Voltmeter, Tune-Up Cable, SINAD meter	1. Set signal generator output to – 60dBm. Apply 1000Hz modulation at 3kHz deviation. 2. Adjust volume control R201 for 2.10Vrms as read on the ac voltmeter. 3. Reduce signal generator output level until 12dB SINAD is displayed on the SINAD meter. 4. Adjust Z1, Z3, and Z2, in that order, to obtain a maximum SINAD reading. Repeat if necessary. 5. Decrease signal generator output until 12dB SINAD is displayed on the SINAD meter. Signal level mut be less than 0.35uV for 12dB SINAD.
4A ALTERNATE METHOD	Z1, Z2, Z3	20dB quieting	Speaker Jack J202	Signal Generator, AC Voltmeter, Tune-Up Cable	1. Set signal generator output to – 60dBm. 2. Adjust Z1, Z3 and Z2, in that order, for a minimum noise level. Readjustment of the signal generator output may be necessary to obtain a noise level reading on the ac voltmeter. 3. Decrease signal generator level and insure that the reference noise level is 1.05Vrms. 4. Increase signal generator output level until noise level decreases 20dB. Signal level must be less than 0.5uV for 20dB quieting.

DISASSEMBLY PROCEDURE

① Turn off the radio.

② While pushing the spring-loaded battery latch towards the top of the radio, slide the battery from left to right, removing it from the base plate on the bottom of the radio housing.

③ Loosen the two captive screws on the bottom of the radio (base plate). Do not completely remove the captive screws from the base plate.

④ With a thumb and forefinger, grasp the antenna at its base and pull lightly to remove the frame assembly from the radio housing. Do not depress the PTT switch during removal.

⑤ Lift the speaker bracket assembly from the frame assembly, being careful not to pull against the speaker/microphone wires.

⑥ Disconnect the speaker/microphone 4-pin connector from the circuit board by pulling straight out and away from the circuit board. Notice the alignment of the polarized connector.

NOTE: Refer to the exploded view diagram if further disassembly is necessary.

Assemble the radio in the reverse order of disassembly, making certain:

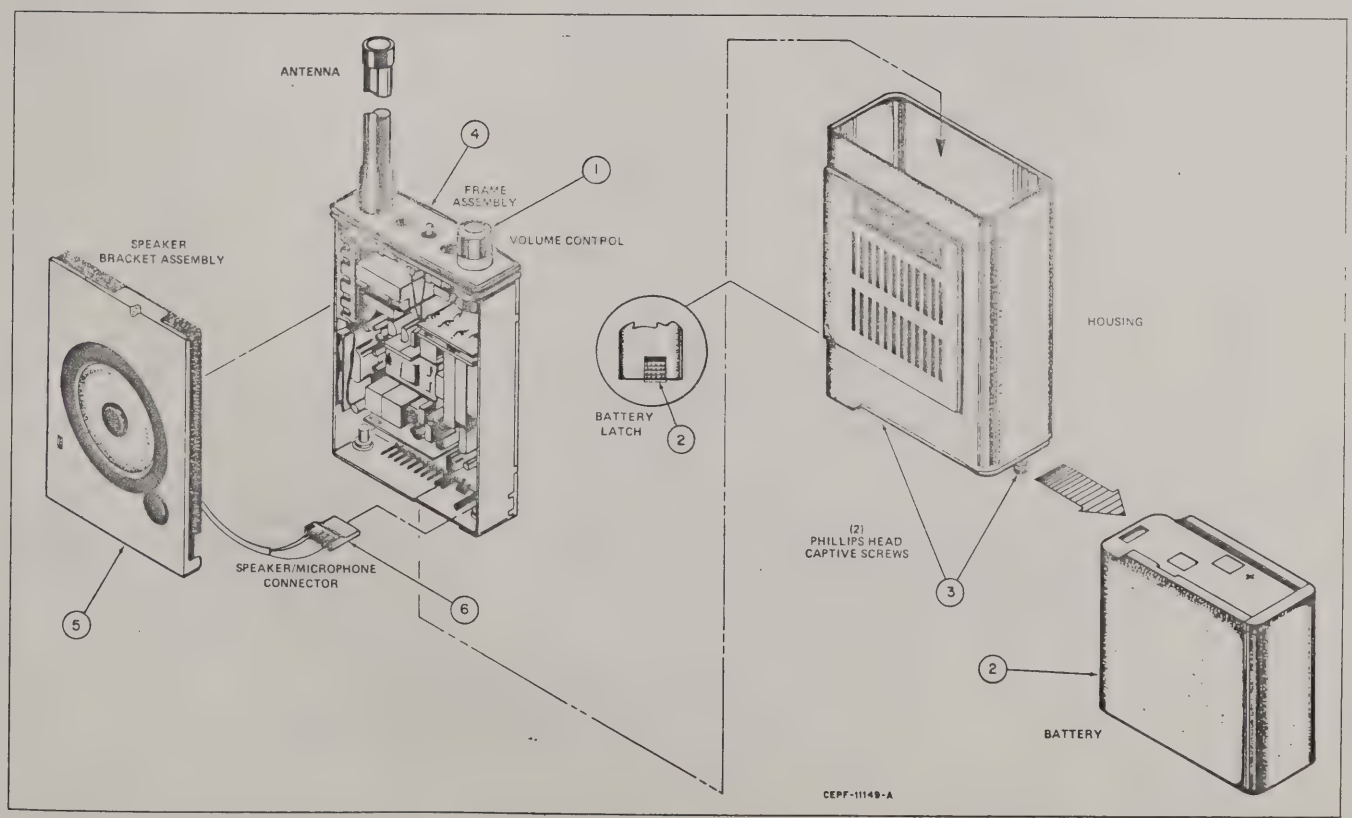
- to align the speaker/microphone connector pins to the socket before pressing the connector pins in place.
- to dress the wires within the frame to prevent their being pinched by the speaker bracket when inserted into the housing.
- that the lip of the speaker bracket fits under the top edge of the frame assembly.
- that the two frame O-rings and control head O-ring are in place.
- to observe proper frame assembly orientation before insertion into the radio housing.
- to tighten all hardware, loosened or removed during disassembly, per the torque specifications listed in the Torque Specifications table.
- that the speaker bracket tabs, located at the bottom corners and top center of the speaker bracket, are bent so as to achieve the extremely tight tab-to-frame contact necessary for proper rf grounding.

CAUTION

Inspect the frame O-rings and control head O-ring and replace if obvious damage exists.

TORQUE SPECIFICATIONS

APPLICATION	TORQUE (IN. LBS.)
Antenna Bushing Spanner Nut	12.0
Antenna Jack Spanner Nut	3.0
Speaker Jack Spanner Nut	3.0
Frequency Switch Spanner Nut	6.0
Base Plate Mounting Screws	4.0
Battery Contacts Mounting Screws	3.0
Power Amplifier to PC Board Mounting Screws	3.0
PC Board to Frame Mounting Screws	3.0
Control Head to Frame Mounting Screws	4.0



GENERAL

Radios are aligned at the factory to provide peak performance over a long period of time, and no further adjustments are necessary. Realignment may be required if components are replaced or have aged. If it is necessary to realign the radio, perform the following procedures. Refer to the Theory/Maintenance Manual for list of recommended test equipment.

1. Remove the battery and disassemble the radio, as shown in the "Disassembly Procedure."
2. Connect a dc power supply to the radio as follows: power supply negative to pin 2 of J401 (or to radio frame) and power supply positive to pin 3 of J401.
3. Adjust the power supply output for 7.5Vdc and current limiting at 750mA.
4. Perform either the "Transmitter Alignment" procedure or the "Receiver Alignment" procedure, or both, as required.

TRANSMITTER ALIGNMENT

Preliminary Adjustments:

1. Connect a frequency counter to the antenna jaek (J201) through a 50Ω, 30dB attenuating pad.
2. Set frequency switch S204 to the highest frequency channel.
3. Set cores L101 and L104 flush with the solder side of the circuit board.
4. Set "Instantaneous Deviation Control" (IDC) R107 and XMIT POWER ADJ R110 potentiometers to their midrange position.
5. Make all measurements with radio "keyed" (i.e., PTT switch S202 depressed).

STEP	ADJUST	FOR	MEASURED AT	USING	NOTE
1	L104 (F1) L101 (F2)	Carrier frequency marked on the back cover label	Antenna Jack J201	Frequency Counter (through a 30dB attenuating pad)	Adjust the appropriate warp coil until the transmitter frequency is read on the counter.
2	Power Adjust R110	Maximum rated current drain	Antenna Jack J201	RF Wattmeter (through a 30dB attenuating pad)	Adjust for maximum rated current drain with at least 1.0W rf power output.
3	IDC Potentiometer R107	±5kHz deviation	Antenna Jack J201	Deviation Meter (through a 30dB attenuating pad) 1. Audio Oscillator connected to IDC Module U101, Deviation Meter (through a 30dB attenuating pad). 2. When making deviation measurement and test cable is not available, audio input to IDC module at pin 6 should be fed thru a 15k resistor in series with an 0.15uF capacitor.	1. Set audio oscillator for an output of 0.1Vrms at 1000Hz. Check the deviation on all channels, and adjust R107 for ±5kHz deviation on the channel that produces the highest deviation. 2. Readjust the frequency per step 1. Repeat deviation adjustment if necessary. 3. If the deviation imbalance between F1 and F2 is greater than ±950Hz, perform step 4. **NOTE:** After any deviation adjustment or installation of R106 or R106A, readjustment of the transmitter frequency (F1 and/or F2) is required.
4	Deviation Imbalance R106, R106A	Deviation balance between F1 and F2	Antenna Jack J201	Deviation Meter (through a 30dB attenuating pad)	1. Install a 120kΩ ¼W resistor on the circuit board for the channel (R106 for F1 or R106A for F2) that produces the highest deviation. 2. Repeat step 3.

f_c = carrier frequency, f_o = oscillator frequency, $f_c = 9f_o$

NOTE: To increase modulation sensitivity, increase the value of R102.

20dB QUIETING TEST (Perform on each channel)

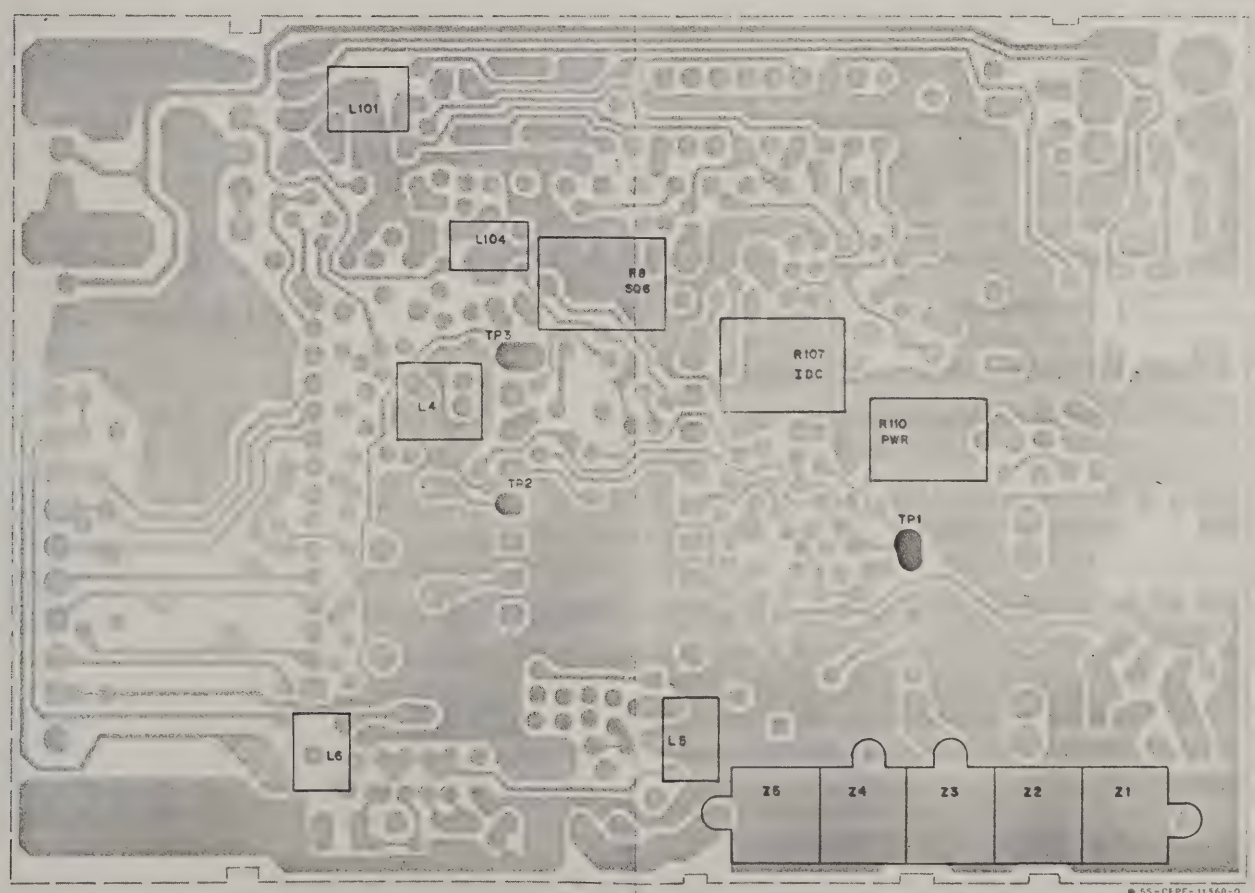
STEP	ADJUST	FOR	MEASURED AT	USING	NOTE
1	Volume Control R201	1.05 Volts ac	Speaker Jack J202	AC Voltmeter Tune-Up Cable	Establishes reference noise level.
2	Service Monitor Frequency & Output Adjustment Controls	Carrier Frequency & maximum output	Antenna Jack J201	Service Monitor Tune-Up Cable	Reduce service monitor output level to zero after setting frequency.
3	Service Monitor Output Level	Slowly increase until noise decreases 20dB	Speaker Jack J202	AC Voltmeter Tune-Up Cable	Signal level must be less than 0.5uV for 20dB quieting.

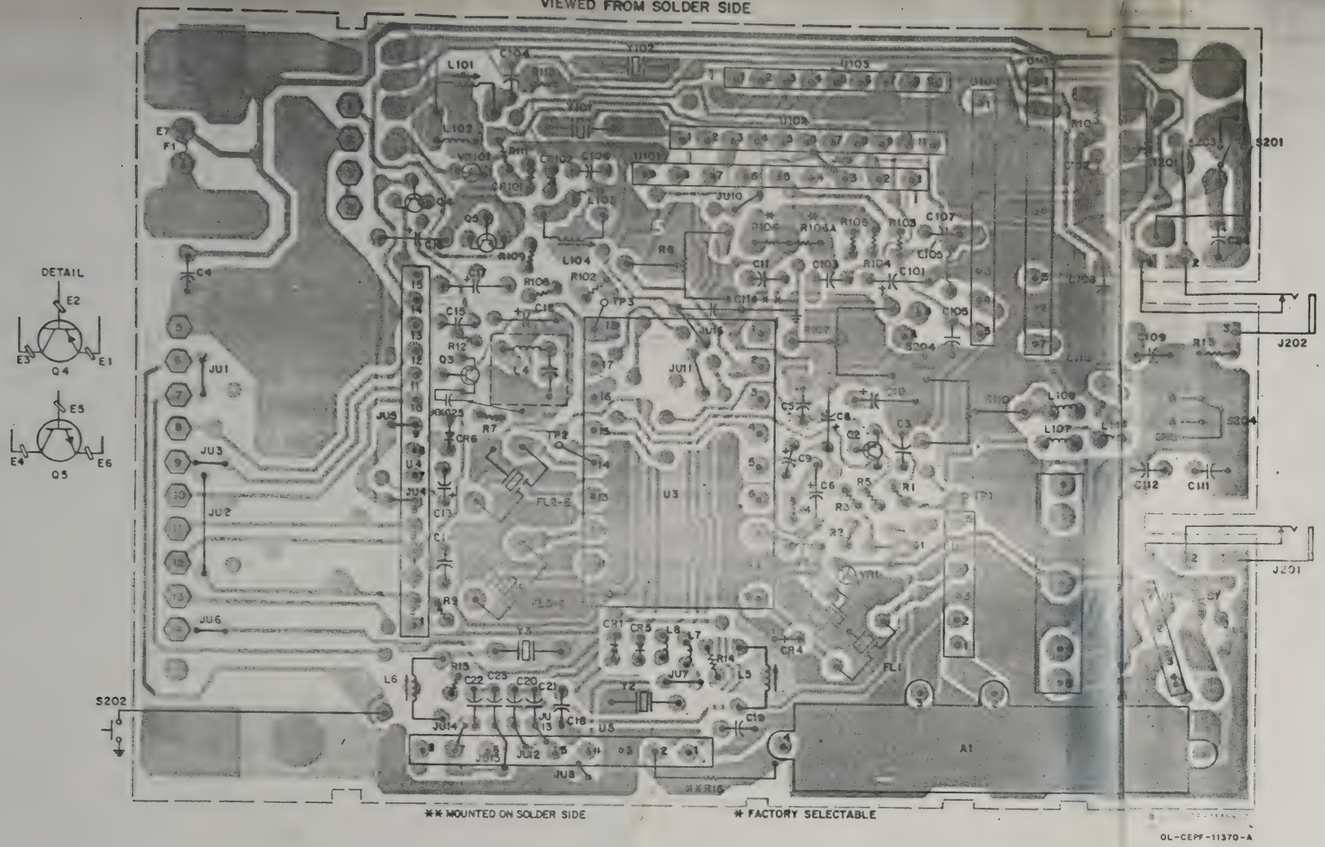
f_c = carrier frequency, f_o = oscillator frequency
406-420MHz: $f_c = 7f_o + 45MHz$
450-512MHz: $f_c = 8f_o + 45MHz$

Post Receiver Alignment Adjustments:

1. Adjust the signal generator for a level sufficient to obtain 12dB SINAD.
2. Adjust squelch control R201 clockwise until the audio noise just stops.

ALIGNMENT AND TEST POINT LOCATIONS





SCHEMATIC AND CIRCUIT BOARD NOTES

1. UNLESS OTHERWISE STATED, RESISTANCES ARE IN OHMS (K = 1000). CAPACITANCES LESS THAN 1 ARE IN MICROFARADS (uF) AND CAPACITANCES 1 OR GREATER ARE IN PICOFARADS (pF).
2. DC VOLTAGES ARE MEASURED FROM POINT INDICATED TO CHASSIS GROUND, USING MOTOROLA S-1063 DC MULTIMETER OR EQUIVALENT.
3. REFERENCE DESIGNATIONS ARE ASSIGNED IN THE FOLLOWING MANNER:
   UNITS SERIES = RECEIVER
   100 SERIES = TRANSMITTER
   200 SERIES = CONTROLS, EXTERNAL SPEAKER & ANTENNA JACKS
   400 SERIES = SPEAKER/MICROPHONE CONNECTOR
4. ⬡ INDICATES INTERCONNECT TIE POINTS;
   ◇ INDICATES VOLTAGE DISTRIBUTION POINTS
5. JUMPER INFORMATION (see table at right)

REF. DESIG.	JUMPER CUT FOR
JU1	PL-DPL Models
*JU2	All H701 (Individual Call) & H703 (Group Call) Options (Sel-Call) with Var. Alert
JU3	All H701 & H703 Options with Fixed Alert
JU4	All H701 & H703 Options
JU5	Future Option Use
JU6	DPL Models with H563 Option, High Side 2nd Oscillator Injection
JU7	All Radios with Two Channel Transmit Capability (T2) and One Channel Receive (R1)
JU8	All T2 R2 and T1 R2 Radios
JU9	All T2 R2 and T2 R1 Radios
JU10	All T1 R2 Radios
JU11	All T2 R1 Radios
JU12	Rec. Crystal in F1 Coded Green
JU13	Rec. Crystal in F1 Coded Blue
JU14	Rec. Crystal in F2 Coded Green
JU15	Rec. Crystal in F2 Coded Blue
JU16	Option H501; Delete Y102, R112
JU301	Options H820 and H804; PL on Transmit Only
JU302	Option H804; PAC•RT PL on Transmit Only
JU601	Options H820 and H804; PL on Transmit Only
JU602	Option H804; PAC•RT PL on Transmit Only
JU603	Option H804; PAC•RT PL on Transmit Only

EPF-11449-A

* Jumper JU2 is cut for Sel-Call with Var. Alert and all other non Sel-Call models.

TRANSMITTER TEMPERATURE COMPENSATION

CRYSTAL COLOR CODE Y101 OR Y102	COMPENSATION RESISTOR VALUE R111 OR R112
GREEN	2.2k ± 5%
RED	1.2k ± 5%
BLUE	470 ± 5%
WHITE	18 ± 5%

EPF-11595-O

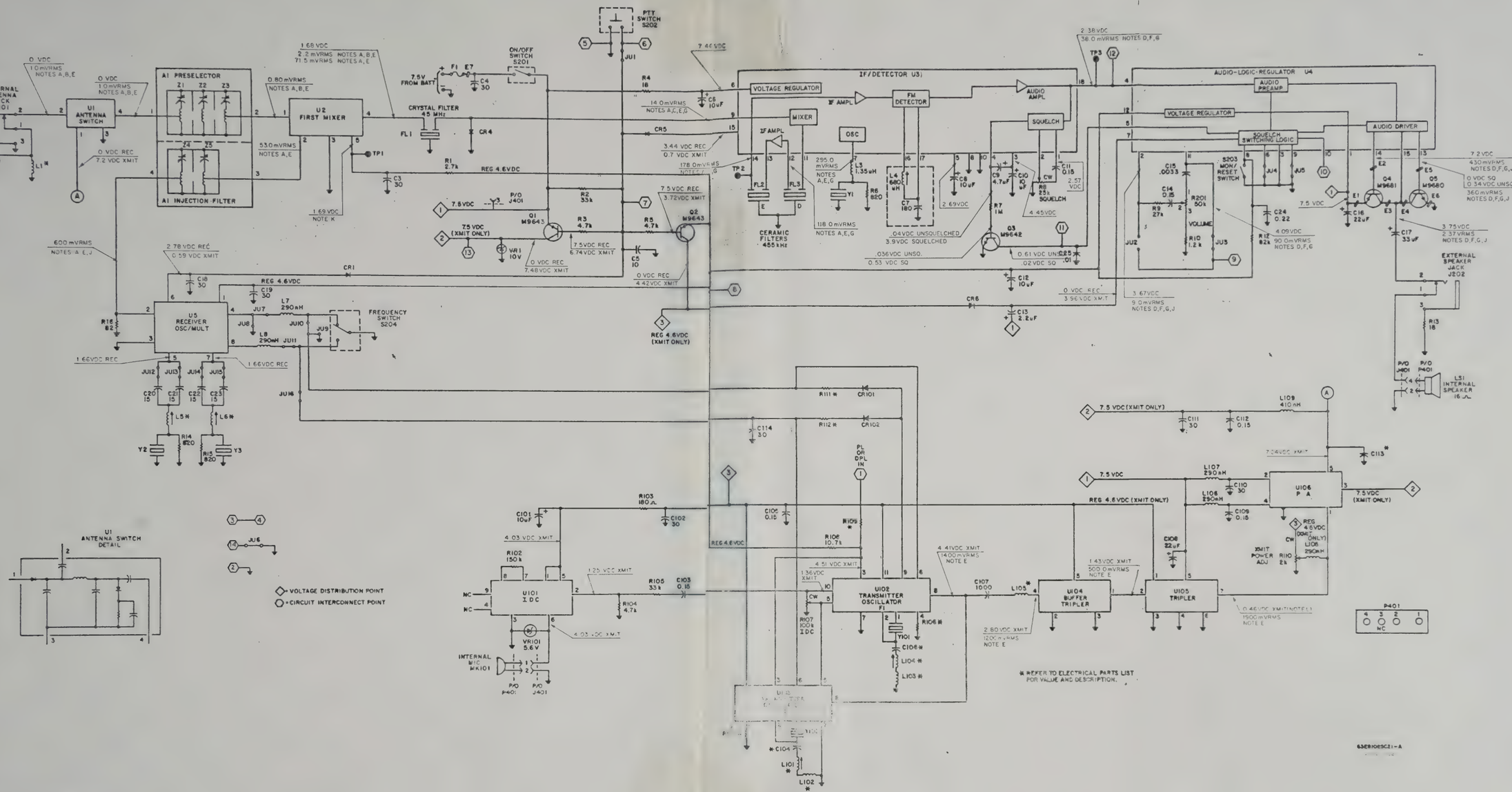
RECEIVER OSCILLATOR CRYSTAL FREQUENCIES

CARRIER FREQUENCY f_c	FIRST OSCILLATOR CRYSTAL FREQUENCY f_{o1}	SECOND OSCILLATOR CRYSTAL FREQUENCY f_{o2}
406.000-408.185	51.5714-51.8836	45.455
408.185-408.518	51.8836-51.9311	44.545
408.518-409.095	51.9311-52.0136	45.455
409.095-409.315	52.0136-52.0450	44.545
409.315-411.891	52.0450-52.4130	45.455
411.891-413.219	52.4130-52.6027	44.545
413.219-415.685	52.6027-52.9550	45.455
415.685-418.541	52.9550-53.3630	44.545
418.541-420.000	53.3630-53.5714	45.455
450.000-451.000	50.6250-50.7500	44.545
451.000-453.000	50.7500-51.0000	45.455
453.000-455.800	51.0000-51.3500	44.545
455.800-456.500	51.3500-51.4375	45.455
456.500-460.100	51.4375-51.8875	44.545
460.100-461.075	51.8875-52.0094	45.455
461.075-461.150	52.0094-52.0188	44.545
461.150-461.400	52.0188-52.0500	45.455
461.400-464.900	52.0500-52.4875	44.545
464.900-466.550	52.4875-52.6938	45.455
466.550-470.000	52.6938-53.1250	44.545
470.000-473.400	53.1250-53.5500	45.455
473.400-475.100	53.5500-53.7625	44.545
475.100-480.200	53.7625-54.4000	45.455
480.200-480.700	54.4000-54.4625	44.545
480.700-480.980	54.4625-54.4975	45.455
480.980-482.150	54.4975-54.6438	44.545
482.150-489.600	54.6438-55.5750	45.455
489.600-489.900	55.5750-55.6125	44.545
489.900-491.400	55.6125-55.800	45.455
491.400-492.900	55.8000-55.9875	44.545
492.900-498.300	55.9875-56.6625	45.455
498.300-498.800	56.6625-56.7250	44.545
498.800-499.050	56.7250-56.7563	45.455
499.050-502.600	56.7563-57.2000	44.545
502.600-507.450	57.2000-57.8063	45.455
507.450-507.850	57.8063-57.8563	44.545
507.850-508.100	57.8563-57.8875	45.455
508.100-508.600	57.8875-57.9500	44.545
508.600-512.000	57.9500-58.3750	45.455

Crystal Formula: $f_c = 7f_{o1} + 45MHz$ (406-420MHz)
$f_c = 8f_{o1} + 45MHz$ (450-512MHz)

EPF-11471-O

TRANSCEIVER CIRCUIT BOARD DETAIL



SCHEMATIC OVERLAY NOTES:

A. 1000uV CARRIER SIGNAL
B. DISABLE FIRST OSCILLATOR FOR THIS READING
C. DISABLE SECOND OSCILLATOR FOR THIS READING
D. 1000uV CARRIER SIGNAL WITH 1000Hz TONE AT 3kHz DEVIATION
E. MEASUREMENT MADE WITH MOTOROLA MODEL S-1339 ANALOG RF MILLIVOLTMETER
F. MEASUREMENT MADE WITH HEWLETT-PACKARD MODEL 400 FL AC VOLTMETER
G. RECEIVER SQUELCHED
H. NO RF SIGNAL IN
J. RATED AUDIO OUTPUT SET AT 7.5VDC (2.19VRMS)
K. WILL VARY WITH OSCILLATOR INJECTION
L. VARIES WITH SETTING OF R110

ITEM REVISIONS CHART

ITEM NO.	FREQ. (MHz)	NO. CHANNELS	SUFFIX
NUE6361A	406-420	1	
NUE6362A	450-469.999	1	
NUE6363A	470-489.999	1	
NUE6364A	490-512	1	
NUE6371A	406-420	2	
NUE6372A	450-469.999	2	
NUE6373A	470-489.999	2	
NUE6374A	490-512	2	

EPF-11470-O

Exploded View Parts List

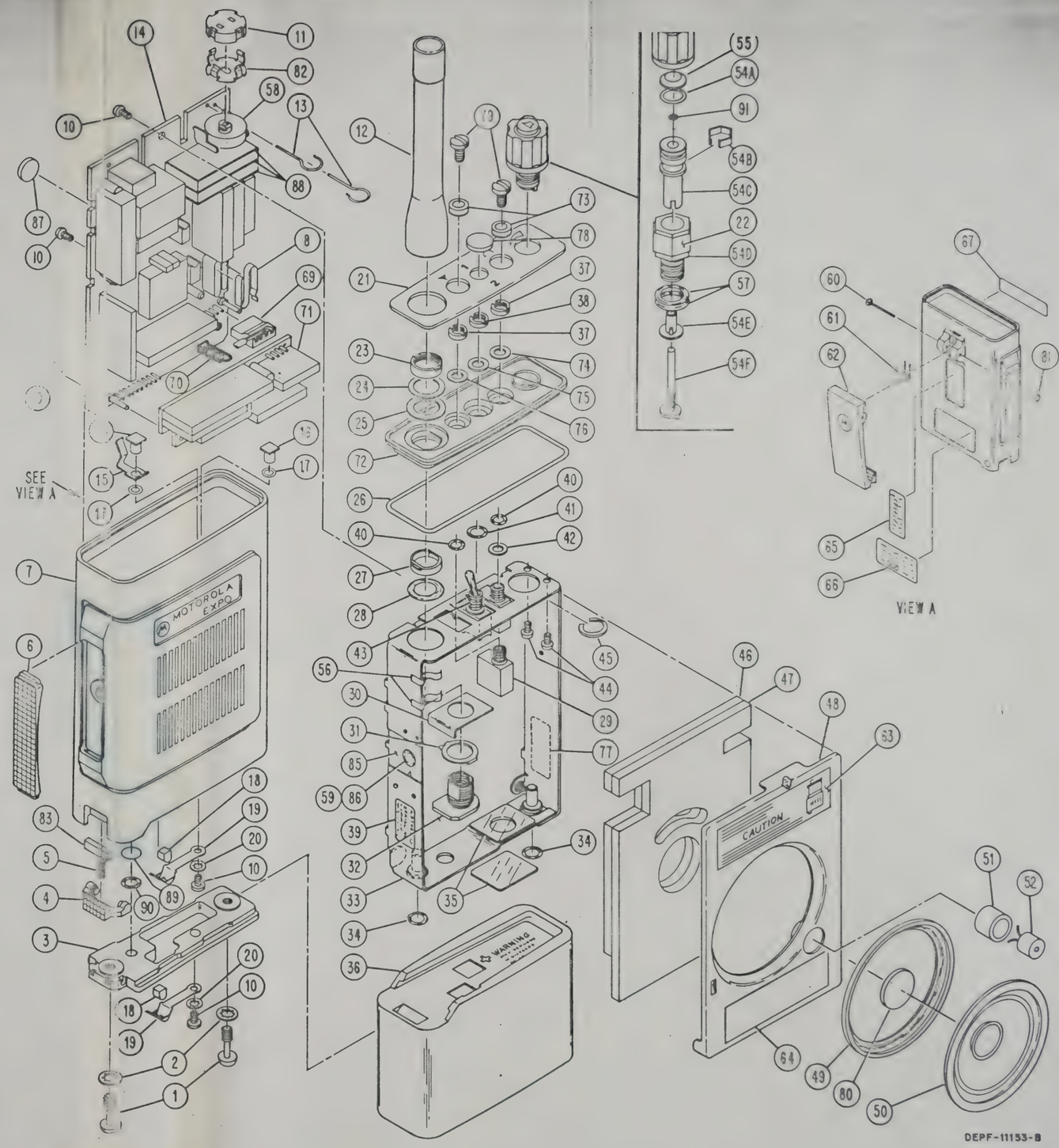
PLF-1946-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	0305941K01	SCREW, Captive; 4-40
2	0400009761	LOCKWASHER, Internal Tooth; #4
3	6405946K01	PLATE, Base; Standard Models
	or 6405946K03	PLATE, Base; Submersible Models
4	5505940K01	LATCH, Battery
5	4105944K01	SPRING, Battery Latch
6	4505103L01	LEVER, Push-to-Talk Flex
7	0105953H93	HOUSING ASSEMBLY, Standard, Smooth Back
	or 0105950J88	HOUSING ASSEMBLY, Submersible; Smooth Back
	or 0105953H94	HOUSING ASSEMBLY, Standard; Belt-Clip Back
	or 0105959J89	HOUSING ASSEMBLY, Submersible; Belt Clip Back
8	4205246M01	CLIP, Ground; Crystal
9		Not Used
10	0300138651	SCREW, 2-56 × 0.125"
11	4305242L01	BUSHING, Drive
12	NAE6231A	ANTENNA, Helifiex, 406-420MHz
	or NAE6232A	ANTENNA, Helifiex, 450-469.999MHz
	or NAE6233A	ANTENNA, Helifiex, 470-512MHz
13	3905235L01	CONTACT, 3-Way
14		CIRCUIT BOARD
15	3905939K01	CONTACT, B +
16	4605945K01	STUD, Battery Contact
17	3205082E24	GASKET, O-Ring; Battery Contact
18	0705830C01	SUPPORT, Battery Contact
19	3905421C03	CONTACT, Battery
20	0400002625	LOCKWASHER, Internal Tooth; #2
21		ESCUTCHEON
	1305212L01	Two-Frequency Standard Models
	or 1305212L02	One-Frequency Standard Models
	or 1305212L06	PAC-RT Standard Models
	or 1305212L07	Two-Frequency Submersible Models
	or 1305212L08	One-Frequency Submersible Models
	or 1305212L12	PAC-RT Submersible Models
22	1105942L02	ADHESIVE, Control Knob
23	0205765L01	NUT, Spanner; Antenna
24	0405216L04	WASHER, Flat; Antenna
25	1405210L01	INSULATOR, Nut; Antenna
26	3205082E18	GASKET, O-Ring; Panel
27	1405208L01	INSULATOR, Bushing; Antenna
28	3205082E21	GASKET, O-Ring; Antenna Bushing
29	See Notes I & II	CONNECTOR, Antenna (J201)
30	1405209L01	INSULATOR, Lug; Antenna
31	2905211L01	LUG, Antenna
32	4305213L01	BUSHING, Antenna
33	0105953H84	FRAME ASSEMBLY
34	3205082E23	GASKET, O-Ring; Frame Bushing
35	1405209L02	INSULATOR, Contact
36	-----	TYPICAL BATTERY PACK
37	0205050E01	NUT, Spanner
38	0282653D01	NUT, Spanner
39	5405516L01	LABEL, Serial
40	3205082E22	GASKET, O-Ring
41	3205082E20	GASKET, O-Ring
42	0405216L06	WASHER, Insulator
43	See Note I	SWITCH, Frequency (S204)
44	0305381L01	SCREW, Self-Tapping; 2-56 × 0.125"
45	4205234L01	RING, Retaining; Crescent
46	7505298L02	PAD, Speaker Bracket; Option (See Note II)
47	7505298L01	PAD, Speaker Bracket (See Note II)
48	0705198L01	BRACKET, Speaker (See Note II)
49	3705177K01	TUBING, Heat Shrinkable (See Note II)
50	See Notes I & II	SPEAKER (LS1)
51	1405299L01	BOOT, Microphone (See Note II)
52	See Notes I & II	MICROPHONE (MK1)
53	3805237L01	CAP, Control Knob
54	0105953H87	ASSEMBLY, Switch; 3-way; includes items 54A thru 54F
54A	-----	GASKET, O-Ring
54B	-----	BAND CLUTCH
54C	-----	SHAFT, Actuator
54D	-----	HOUSING, Shaft
54E	-----	BUSHING, Shoulder
54F	-----	SHAFT, Drive
55	3905784L01	CONTACT, Molded
56	4205250M01	CLIP, Ground; Preselector
57	3205082E19	GASKET, O-Ring
58	See Note I	CONTROL, Volume (S201)
59	0105953H85	CIRCUIT BOARD, PTT
60	2205862L01	PIN, Retaining; Standard Models
	or 2205862L02	PIN, Retaining; Submersible Models
61	4105120A03	SPRING, Clip Torsion
62	0105953H98	CLIP, Pocket; Standard Models
	or 4205152M02	CLIP, Pocket; Submersible Models
63	5405110M01	LABEL, Instruction (See Note II)
64	5405111M01	LABEL, Patent (See Note II)
65	5405515L02	LABEL, FCC
66	5405449L05	LABEL, Instrinsically Safe
	or 5405449L02	LABEL, Nonincendive
67	3305498L01	NAMEPLATE
69	See Note I	CONNECTOR (P401)
70	See Notes I & II	FUSE (F1)
71	-----	CIRCUIT BOARD, Option
72	6405214L01	PANEL, Top
73	0483799H04	GASKET, Screw
74	0405216L03	WASHER, Insulator
75	0405216L01	WASHER, Flat
76	0405216L02	WASHER, Flat
77	5405171E01	LABEL, Intrinsically Safe
78	3805216L02	PLUG, Seal; Frequency Switch (One-Frequency Models)
79	0310129A24	SCREW, Nylon; 4-40 × 0.188"
80	7505136L02	PAD, Speaker
81	0205863L01	NUT, Spring
82	4205810L01	CLIP, Bushing
83	7505136L01	PAD, Battery Latch
84		Not Used
85	3205264L03	SEAL, Dome
86	3905834K04	CONTACT, Snap Dome
87	7505136L03	PAD, Circuit Board
88	7505117E12	PAD, Module (for U104 & U105)
89	3205472M01	SEAL, Port; Submersible Models only
90	3205082E25	GASKET, O-Ring; Submersible Models only
91	3205082E41	GASKET, O-Ring

NOTES:

I. Refer to Electrical Parts List for part number and description.

II. Items 46, 47, 48, 49, 50, 51, 52, 63, 64, and 69 comprise the NLN9467A Speaker/Bracket Assembly.



(D) 406-420MHz (M) 470-489.999MHz
(L) 450-469.999MHz (H) 490-512MHz PLF-1929-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		ASSEMBLY: Preselector/Filter
A1	0105953H77	406-420MHz
	or 0105953H78	450-469.999MHz
	or 0105953H79	470-489.999MHz
	or 0105953H80	490-512MHz
		CAPACITOR, Fixed: uF ± 20%; 25V unless stated
C1	2184511B43	43pF ± 10%; N150 ± 30(D)
	or 2184511B86	30pF ± 5%; N470 ± 70(L)
	or 2184511B65	20pF ± 5%; NPO ± 30(M)
	or 2184511B42	24pF ± 10%; N150 ± 30(H)
C2		Not Used
C3, 4	2182358G96	30pF ± 10%; N150
C5	2184511B73	10pF ± 5%; N150
C6	2382397D15	10; 20V
C7	-----	Part of L4
C8	2382397D15	10; 20V
C9	2383397D09	4.7; 6V
C10	2382397D15	10; 20V
C11	2184008H11	0.15; 35V
C12	2382397D15	10; 20V
C13	2382397D19	2.2; 10V
C14	2184008H11	0.15 + 80 – 20%; 50V
C15	2184008H02	.0033
C16	2382397D16	22; 10V
C17	2382397D18	33; 10V
C18, 19	2182358G96	30pF ± 10%; N150
C20	2105311E70	15pF ± 10%; N1500
C21	2184511B39	15pF ± 10%; NPO
C22	2184511B39	15pF ± 10%; NPO (2-Freq. Models)
C23	2105311E70	15pF ± 10%; N1500 (2-Freq. Models)
C24	2382397D06	0.22 + 40 – 20%
C25	2105158A43	.01 ± 5%; 50V
C101	2382397D15	10; 20V
C102	2182358G96	30pF ± 10%; N150
C103	2184008H11	0.15 + 80 – 20%; 50V
C104	2100864521	30pF ± 10%; N750 (2-Freq. Models)
C105	2184008H11	0.15 + 80 – 20%; 50V
C106	2100864521	30pF ± 10%; N750
C107	2182213E08	1000pF ± 5%; 100V
C108	2382397D16	22; 15V
C109	2184008H11	0.15 + 80 – 20%; 50V
C110, 111	2182358G96	30pF ± 10%; N150
C112	2184008H11	0.15 + 80 – 20%; 50V
C113	2184511B31	1.0 ± .25pF; NPO (D,M)
	or 2184511B03	1.5 ± .25pF; NPO (L)
	or 2184511B33	1.3 ± .25pF; NPO (H)
C114	2105157A80	30pF ± 5%; 50V
		DIODE: See Note
CR1	4883654H01	Silicon
CR2, 3		Not Used
CR4, 5, 6	4883654H01	Silicon
CR101	4883654H01	Silicon
CR102	4883654H01	Silicon (2-Freq. Models)
		CORE:
E1, 2, 3	-----	Ferrite Bead; part of Q4
E4, 5, 6	-----	Ferrite Bead; part of Q5
E7	-----	Ferrite Bead; part of F1
		FUSE:
F1	6505214E01	2-amp
		FILTER:
FL1	4805536F03	Crystal, 45MHz
FL2	4805368G04	Ceramic, 455kHz
FL3	4805368G03	Ceramic, 455kHz
		JACK:
J201	0905537F02	External Antenna
J202	0905537F02	External Speaker
J401	0905258L01	Connector, Receptacle (4 req'd)
		COIL, RF: unless stated
L1	2405027E32	2½turns (D,L)
	or 2405027E11	2½turns (M)
	or 2405027E38	3½turns (H)
L2		Not Used
L3	2405652E04	1.3uH Choke
L4	2405716G02	680uH Quadrature Coil; Contains C7
L5	2405444F22	Coded: Red, 12¼ turns closewound, includes 7682451B08 Core (D)
	or 2405444F21	Coded: Grn 11¼ turns closewound; includes 7682451B08 Core (L)
	or 2405444F24	Coded: ORG, 10½ turns closewound; includes 7682451B08 Core (M)
	or 2405444F23	Coded: WHT, 9¼ turns closewound; includes 7682451B08 Core (H)
L6	2405444F22	Coded; RED, 12¼ turns closewound, includes 7682451B08 Core (D) (2-Freq. Models)
	or 2405444F21	Coded: GRN, 11¼ turns closewound; includes 7682451B08 Core (L) (2-Freq. Models)
	or 2405444F24	Coded: ORG, 10½ turns closewound; includes 7682451B08 Core (M) (2-Freq. Models)
	or 2405444F23	Coded: WHT, 9¼ turns closewound; includes 7682451B08 Core (H) (2-Freq. Models)
L7, 8	2482723H04	290nH Choke
L101	2405444F25	Coded: GRN, 8¼ turns closewound; includes 7682451B07 Core (D,H) (2-Freq. Models)
	or 2405444F26	Coded: Red, 10¼ turns closewound; includes 7682451B07 Core (L) (2-Freq. Models)
	or 2405444F27	Coded: WHT, 8¼ turns closewound; includes 7682451B07 Core (M) (2-Freq. Models)
L102	2482723H04	290nH Choke (D) (2-Freq. Models)
	or 2482723H22	150nH Choke (L,M,H) (2-Freq. Models)
L103	2482723H04	290nH Choke (D)
	or 2482723H22	150nH Choke (L,M,H)
L104	2405444F25	Coded: GRN, 8¼turns closewound; includes 7682451B07 Core (D,H)
	or 2405444F26	Coded: RED, 10¼turns closewound; includes 7682451B07 Core (L)
	or 2405444F27	Coded: WHT, 8¼turns closewound; includes 7682451B07 Core (M)
L105	2482723H05	410nH Choke (D)
	or 2482723H04	290nH Choke (L,M,H)
L106, 107, 108	2482723H04	290nH Choke
L109	2482723H05	410nH Choke
LS1	0105958H61	**SPEAKER ASSEMBLY**
MK101	5005227J01	**MICROPHONE**
		PLUG:
P401	0105953H90	Speaker/Microphone Connector Assembly
		TRANSISTOR: See Note I
Q1, 2	4800869643	PNP; type M9643
Q3	4800869642	NPN; type M9642
Q4	0105957H13	Assembly, PNP; type M9681; includes 7683960B06 Ferrite Bead
Q5	0105957H14	Assembly, NPN; type M9680; includes 7683960B06 Ferrite Bead
		RESISTOR Fixed: Ω ± 5%; ⅛W unless stated
R1	0660075C59	2.7k
R2	0660075C85	33k
R3	0660075C65	4.7k
R4	0605139G07	18

R5	0660075C65	4.7k
R6	0660075C47	820
R7	0660075D22	1.0 Meg
R8	1805690G04	Pot. 25k; Squelch Control
R9	0660075C83	27k
R10	0660075C51	1.2k
R11		Not Used
R12	0660075C95	82k
R13	0605139G07	18
R14	0660075C47	820
R15	0660075C47	820 (2-Freq. Models)
R16	0660075A23	82
R101		Not Used
R102	0611009D02	150k; ¼W
R103	0660075C31	180
R104	0660075C65	4.7k
R105	0660075C85	33k
R106 or R106A	0611009C99	120k; ¼W (2-Freq. Models – See Note III)
R107	1805690G05	Pot. 100k; IDC Control
R108	0605886D33	10.7k; ±1%
R109	0605886D09	100k; ±1% (D, L, M)
	or 0610621D97	124k ±1% ¼W (H)
R110	1805690G01	Pot. 2k; Power Adjust
R111	0660075C57	2.2k (for Y101 Coded: GRN)
	or 0660075C51	1.2k (for Y101 Coded: RED)
	or 0660075C41	470 (for Y101 Coded: BLU)
	or 0605139G07	18 (for Y101 Coded: YEL)
R112	0660075C57	2.2k (for Y102 Coded: GRN) (2-Freq. Models)
	or 0660075C51	1.2k (for Y102 Coded: RED) (2-Freq. Models)
	or 0660075C41	470 (for Y102 Coded: BLU) (2-Freq. Models)
	or 0605139G07	18 (for Y102 Coded: YEL) (2 Freq. Models)
R201	-----	Pot. 50k; Volume Control, part of S201
		SWITCH:
S201	0105953H87	ON-OFF
S202	3905834K01	Control, Snap; Dome (PTT)
S203	-----	Monitor/Reset, part of S201
S204	4005680K02	Toggle, SPDT (2-Freq. Models)
		HYBRID MODULE: See Note I
U1	5105337F41	Antenna Switch
U2	5105337F42	1st Mixer (D,L)
	or 5105337F24	1st Mixer (M,H)
U3	5105337F37	Nucleus
U4	5105337F04	Audio/Logic/Regulator
U5	5105337F44	Receiver Osc./Multiplier (D,L)
	or 5105337F55	Receiver Osc./Multiplier (M,H)
U101	5105337F01	IDC
U102	5105337F45	Transmitter Osc. (D)
	or 5105337F40	Transmitter Osc. (L,M,H)
U103	5105337F48	Transmitter Osc. (D) (2-Freq. Models)
	or 5105337F47	Transmitter Osc. (L,M,H) (2-Freq. Models)
U104	5105337F51	Buffer/Tripler (D)
	or 5105337F43	Buffer/Tripler (L)
	or 5105337F49	Buffer/Tripler (M)
	or 5105337F50	Buffer/Tripler (H)
U105	5105337F54	Tripler (D)
	or 5105337F46	Tripler (L)
	or 5105337F52	Tripler (M)
	or 5105337F53	Tripler (H)
U106	5105337F29	PA (D)
	or 5105337F30	PA (L)
	or 5105337F31	PA (M,H)
		DIODE: See Note I
VR1	4882256C11	10V Zener
VR101	4882256C12	5.6V Zener
		CRYSTAL: See Note II
Y1	NXN6161A	2nd Oscillator (Lo Side) 44.545MHz, Coded violet
	or NXN6161A	2nd Oscillator (Hi Side) 45.455MHz, Coded brown
Y2	KXN6224AA	Receiver
Y3	KXN6224AA	Receiver (2-Freq. Models)
Y101	KXN6222AA	Transmitter
Y102	KXN6222AA	Transmitter (2-Freq. Models)

REFERENCE SYMBOL	MOTOROLA PART NO.	NONREFERENCED ITEMS
	0300136745	SCREW, Phillips; 2-56 × 5/16"
	0305701B01	SLUG, Preselector
	0705196A02	BOOT, Crystal; for Y2, Y3, Y101, Y102
	0705196A04	BOOT, Crystal; for FL1
	1505252L01	HOUSING, for U102
	1505247L01	SHIELD, for U5
	1505246L01	HOUSING, for U103
	1505254L01	HOUSING, for U101
	1505256L01	HOUSING, for U2
	2205376L01	PIN, Guide
	2805418H02	PIN, for Option Circuit Board
	3105437L01	HEADER, for U106
	3105438L01	HEADER, for R106 or R106A
	3105439L01	HEADER, for F1
	3782378B13	BOOT, for Crystal Y1
	4205173L01	CLIP, Ground; for A1
	6405505L01	CONNECTOR, Strip; for J201 and J202
	7505295B02	PAD, for Y101, Y102, Y2, Y3, FL1
	7505380L01	PAD, for Y1
	7505506D04	PAD, for U2
	7505506D20	PAD, for U102
	7505506D21	PAD, for U4
	7505506D25	PAD, for U5, U101

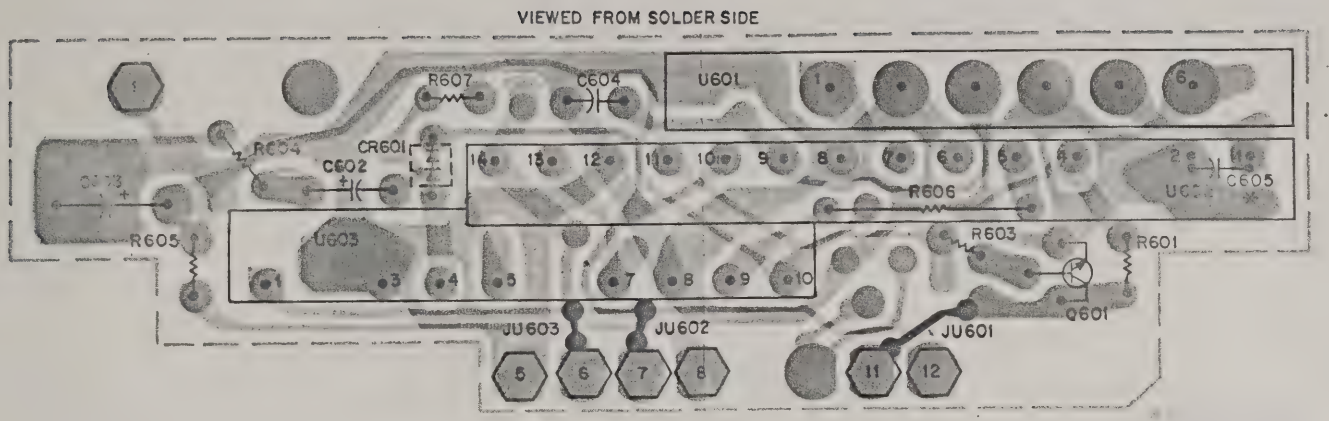
NOTES:

I. For optimum performance, order replacement diodes, transistors, and hybrid modules by Motorola part number only.

II. When ordering crystal units, specify carrier frequency(s), crystal frequency(s), and crystal part number.

III. Use or nonuse of R106 or R106A is determined by the amount of deviation imbalance between F1 and F2 (refer to "Transmitter Alignment Procedure.")

CIRCUIT BOARD DETAIL



* MOUNTED ON SOLDER SIDE OF BOARD

Parts List

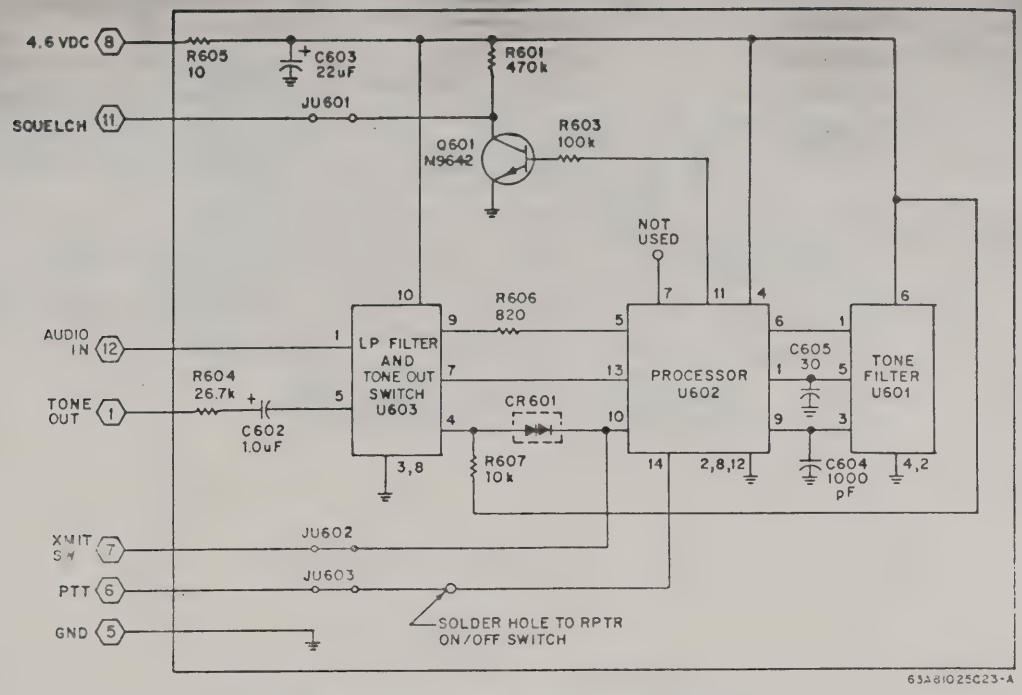
PLF-1[illegible]0-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed:
C601	2182213E09	2000pF ± 5%; 100V
C602	2382397D36	1uF ± 20%; 20V
C603	2382397D16	22uF ± 20%; 15V
C604	2182213E08	1000pF ± 5%; 100V
C605	2105157A60	30pF ± 5%; 50V
		DIODE: See note
CR601	4805562A01	Silicon, 2-Pellet
		TRANSISTOR: See note
Q601	4800869642	NPN; Type M9642
		RESISTOR, Fixed: Ω ± 5%; ⅛W unless stated
R601, 602	0660075D14	470k
R603	0660075C97	100k
R604	0683175C38	26.7k ± 1%; ¼W
R605	0605139G04	10
R606	0660075A47	820
R607	0660075C73	10k
		HYBRID MODULE: See note
U601	NFN6016A	PL Tone Filter (not part of PL kit)
U602	5105337F19	PL Processor
U603	5105337F20	Low-Pass Filter

REFERENCE SYMBOL	MOTOROLA PART NO.	NONREFERENCED ITEM
	0905604C12	SOCKET, Circuit Board

NOTE: For optimum performance, order replacement diodes, transistors, and hybrid modules by Motorola part number only.

SCHEMATIC DIAGRAM



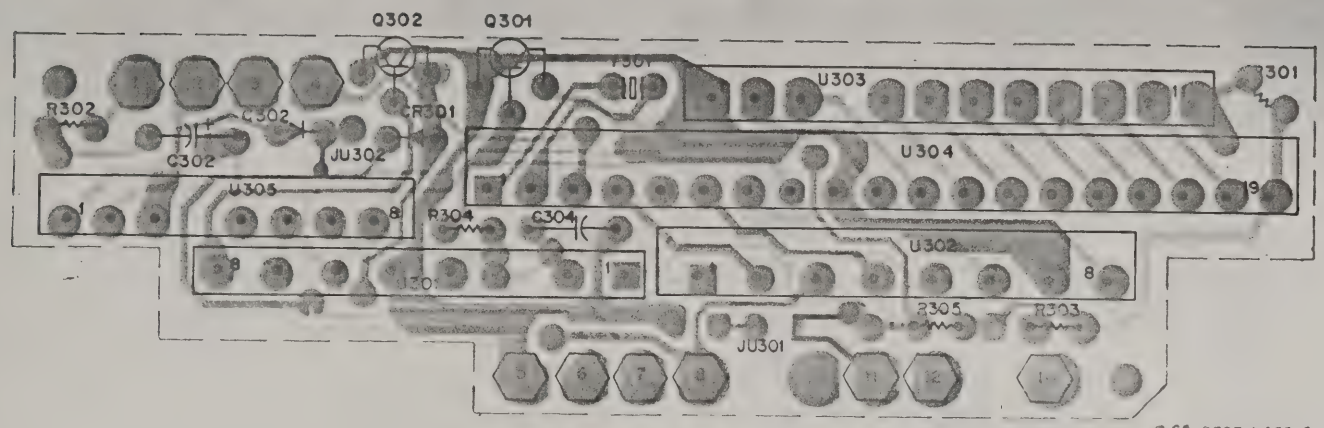
PL TEST MEASUREMENTS CHART

PIN NO.	ENCODE		DECODE	
	DC VOLTS	AC VOLTS	DC VOLTS	AC VOLTS
PL TONE FILTER (U601)				
1	4.32	135mV rms	4.14	290mV rms
2	GROUND	GROUND	GROUND	GROUND
3	4.37	-----	4.39	-----
4	GROUND	GROUND	GROUND	GROUND
5	1.80	100mV rms	1.80	157mV rms
6	4.57	-----	4.57	-----
PL PROCESSOR (U602)				
1	1.80	100mV rms	1.80	157mV rms
2	GROUND	GROUND	GROUND	GROUND
4	4.57	-----	4.57	-----
5	1.88	-----	1.86	101.55mV rms
6	4.32	135mV rms	4.14	290mV rms
8	GROUND	GROUND	GROUND	GROUND
9	4.37	-----	4.39	-----
10	0.70	-----	7.5	-----
11	4.36	-----	200mV	-----
12	GROUND	GROUND	GROUND	GROUND
13	2.0	.343mV rms	2.05	480mV rms
14	11.2mV	-----	1.25	-----
LOW PASS FILTER & TONE OUT SWITCH (U603)				
1	2.75	1.52mV rms	2.03	10.2mV rms
3	GROUND	GROUND	GROUND	GROUND
4	1.95	-----	4.47	-----
5	1.79	339mV rms	1.75	1.03mV rms
7	2.0	343mV rms	2.05	480mV rms
8	GROUND	GROUND	GROUND	GROUND
9	1.89	0.50mV rms	1.89	105mV rms
10	4.57	-----	4.57	-----
INTERCONNECT TIE POINTS				
1	3.57	286mV rms	3.36	1.2mV rms
5	GROUND	GROUND	GROUND	GROUND
6	11.2mV	-----	1.25	-----
7	0.7	-----	7.5	-----
8	4.6	-----	4.6	-----
11	19mV	-----	670mV	-----
12	2.75	1.52mV rms	2.03	10.2mV rms

TEST MEASUREMENTS ARE NOMINAL. DC VOLTAGES ARE 4.6VDC NOMINAL. AC VOLTAGES ARE WITH RADIO FULLY QUIETED AND 750Hz PL TONE DEVIATION. EPF-11452-O

NLN7164A "DPL" DECK CIRCUIT BOARD DETAIL

VIEWED FROM SOLDER SIDE



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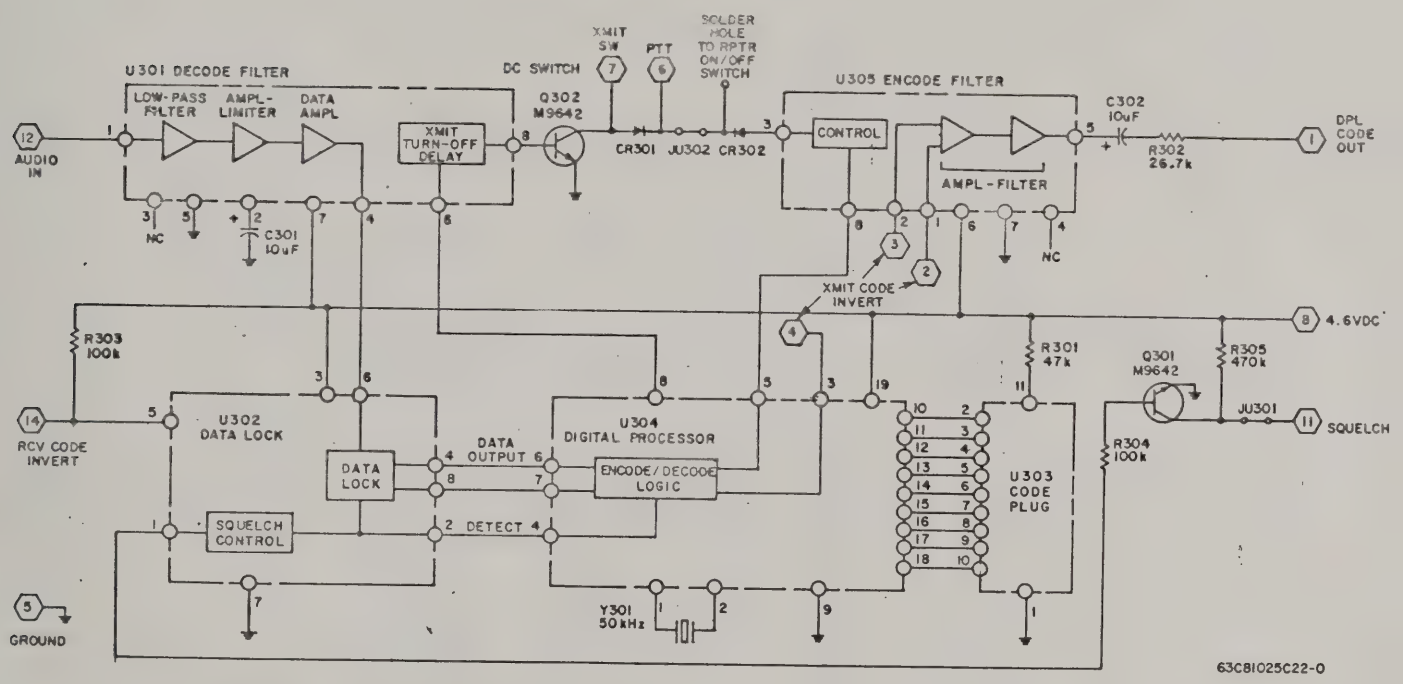
SCHEMATIC DIAGRAM



NLN7164A "Digital Private-Line" Deck

PLF-1931-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed:
C301, 302	2382397D03	10uF ± 20%; 6V
C303	2182213E09	2000pF ± 5%; 100V
		DIODE: See note
CR301, 302	4883654H01	Silicon
		TRANSISTOR: See note
Q301, 302	4800869642	NPN; Type M9642
		RESISTOR, Fixed: Ω ± 5%; ⅛W unless stated
R301	0660075C89	47k
R302	0683175C38	26.7k ± 1%; ¼W
R303, 304	0660075C97	100k
R305, 306	0660075D14	470k
		HYBRID MODULE: See note
U301	5105337F05	Decode Filter
U302	5105337F06	Data Lock
U303	NLN9013A	Code Plug (not part of DPL kit)
U304	5105337F17	Digital Processor
U305	5105337F10	Encode Filter
		CRYSTAL:
Y301	4882656M01	50kHz

REFERENCE SYMBOL	MOTOROLA PART NO.	NONREFERENCED ITEM
	0905604C12	SOCKET, Circuit Board
	3105440L01	HEADER, Code Plug
	7505506D19	PAD, Module (U305)
	7505506D22	PAD, Module (U304)
	7505506D24	PAD, Module (U301 & U302)

NOTE: For optimum performance, order replacement diodes, transistors, and hybrid modules by Motorola part number only.

DPL TEST MEASUREMENTS CHART

PIN NO.	ENCODE		DECODE	
	VOLTAGE	WAVEFORM	VOLTAGE	WAVEFORM
DECODE FILTER U301				
1	2.3Vdc	-----	2.3Vdc	random noise
2	2.3Vdc	-----	2.3Vdc	-----
4	-----	4.5V p-p (1)	-----	4.5V p-p (1)
5	0Vdc	-----	0Vdc	-----
6	4.55Vdc	-----	4.55Vdc	-----
7	4.55Vdc	-----	4.55Vdc	-----
8	0.7Vdc	-----	0Vdc	-----
DATA LOCK U302				
1	4.55Vdc	-----	4.55Vdc	-----
2	0Vdc	-----	0Vdc	-----
3	4.55Vdc	-----	4.55Vdc	-----
4	-----	4.5V p-p (1)	-----	4.5V p-p (1)
5	0Vdc (5)	-----	0Vdc (5)	-----
6	-----	4.5V p-p (1)	-----	4.5V p-p (1)
7	0Vdc	-----	0Vdc	-----
8	-----	4.5V p-p 537.6Hz Pulse Train	-----	4.5V p-p 537.6Hz Pulse Train
CODE PLUG U303				
1	0Vdc	-----	0Vdc	-----
2 thru 10	0Vdc (2)	-----	0Vdc (2)	-----
11	4.55Vdc	-----	4.55Vdc	-----
DIGITAL PROCESSOR U304				
1	2.6Vdc	-----	2.6Vdc	-----
2	-----	-----	-----	-----
3	-----	3.8V p-p (3)	1.85Vdc	-----
4	0Vdc	-----	0Vdc	-----
5	4.55Vdc	-----	0Vdc	-----
6	-----	4.5V p-p (1)	-----	4.5V p-p (1)
7	-----	4.5V p-p 537.6Hz Pulse Train	-----	4.5V p-p 537.6Hz Pulse Train
8	4.55Vdc	-----	0Vdc	-----
9	0Vdc	-----	0Vdc	-----
10 thru 18	0Vdc (2)	-----	0Vdc (2)	-----
19	4.55Vdc	-----	4.55Vdc	-----
ENCODE FILTER U305				
1	0Vdc	-----	0Vdc	-----
2	-----	3.8V p-p (3)	1.85Vdc	-----
3	0.5Vdc	-----	4.55Vdc	-----
5	-----	1.0V p-p (4)	2.4Vdc	-----
6	4.55Vdc	-----	4.55Vdc	-----
7	0Vdc	-----	0Vdc	-----
8	4.55Vdc	-----	0Vdc	-----
INTERCONNECT TIE POINTS				
TIE POINT ○		800mV p-p (4)		3.9Vdc
1	3.9Vdc	-----	3.9Vdc	-----
2	0Vdc	3.8V p-p (3)	0Vdc	-----
3	-----	3.8V p-p (3)	1.85Vdc	-----
4	-----	-----	1.85Vdc	-----
5	0Vdc	-----	0Vdc	-----
6	0Vdc	-----	7.2Vdc	-----
7	0.1Vdc		7.5Vdc	-----
8	4.55Vdc	-----	4.55Vdc	-----
11	.02Vdc	-----	.02Vdc	-----
12	2.3Vdc	-----	2.3Vdc	random noise
14	0Vdc (5)	-----	0Vdc (5)	-----

EPF-11472-A

TEST MEASUREMENTS ARE NOMINAL: NO CARRIER INPUT. NUMBERS IN ( ) REFER TO THE FOLLOWING NOTES:
(1) DIGITAL WAVEFORM **(2)** CODE PLUG REMOVED **(3)** RANDOM DIGITAL WAVEFORM; CHANGES TO MOMENTARY 135Hz WAVEFORM ON DEKEY OF PTT SWITCH, EDGES OF WAVEFORM ARE SQUARE. **(4)** RANDOM DIGITAL WAVEFORM; CHANGES TO MOMENTARY 135Hz WAVEFORM ON DEKEY OF PTT SWITCH, EDGES OF WAVEFORM ARE ROUNDED. **(5)** 4.55 VOLTS IF JUMPER TO 14 IS CUT ON RADIO BOARD; 0 VOLTS IF JUMPER IS NOT CUT.

MOTOROLA INC.

instruction manual revision

general

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

instruction manual affected:

Service, Owner's, and Operator's manuals for Mobile, Base Station, Marine, and Microwave and Rural Telephone RF Equipment

revision details:

The new OSHA safety information provided below supersedes any similar information already included in the instruction manual. File this manual revision directly under the front cover of the manual.

GENERAL SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic energy safety standard which applies to the use of this equipment. Proper use of this radio will result in exposure below the OSHA limit. The following precautions are recommended:

DO NOT operate the transmitter of a mobile radio when someone outside the vehicle is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of a fixed radio (base station, microwave, and rural telephone rf equipment) or marine radio when someone is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of any radio unless all RF connectors are secure and any open connectors are properly terminated.

In addition,

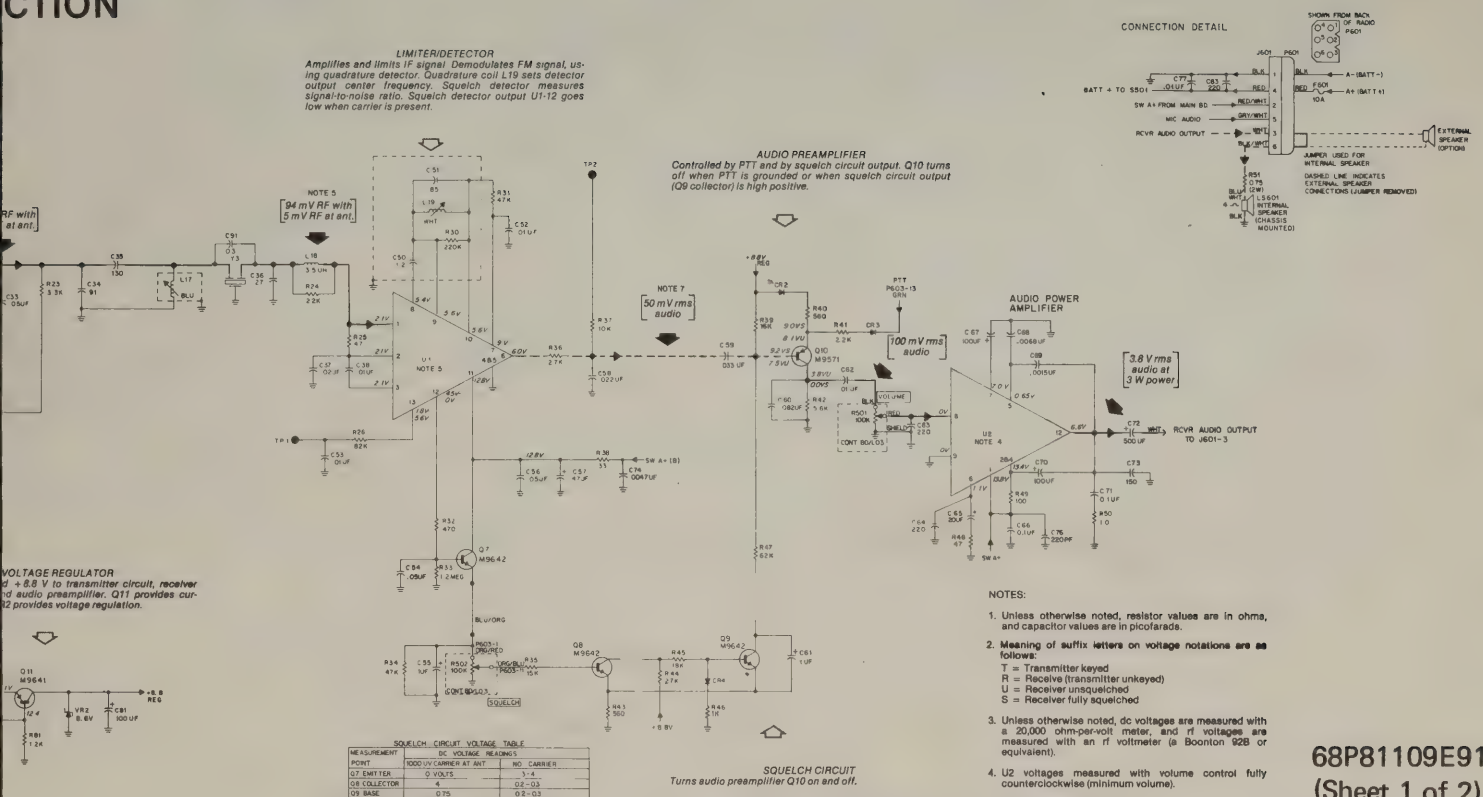
DO NOT operate this equipment near electrical blasting caps or in an explosive atmosphere.

All equipment must be properly grounded according to Motorola installation instructions for safe operation.

All equipment should be serviced only by a qualified technician.

Refer to the appropriate section of the product service manual for additional pertinent safety information.

CTION


LIMITER/DETECTOR
Amplifies and limits IF signal. Demodulates FM signal, using quadrature detector. Quadrature coil L19 sets detector output center frequency. Squelch detector measures signal-to-noise ratio. Squelch detector output U1-12 goes low when carrier is present.
AUDIO PREAMPLIFIER
Controlled by PTT and by squelch circuit output. Q10 turns off when PTT is grounded or when squelch circuit output (Q9 collector) is high positive.
CONNECTION DETAIL
SHOWN FROM BACK OF RADIO P601
J601 P601
BATT + TO S501
SW A+ FROM MAIN BD
MIC AUDIO
RCVR AUDIO OUTPUT
A- (BATT -)
A+ (BATT +) 10A
EXTERNAL SPEAKER (OPTIONS)
JUMPER USED FOR INTERNAL SPEAKER
DASHED LINE INDICATES EXTERNAL SPEAKER CONNECTIONS (JUMPER REMOVED)
LS601 INTERNAL SPEAKER (CHASSIS MOUNTED)
NOTE 5
94 mV RF with 5 mV RF at ant.
NOTE 7
50 mV rms audio
100 mV rms audio
3.8 V rms audio at 3 W power
AUDIO POWER AMPLIFIER
RCVR AUDIO OUTPUT TO J601-3
VOLTAGE REGULATOR
+8.8 V to transmitter circuit, receiver and audio preamplifier. Q11 provides current and U2 provides voltage regulation.
SQUELCH
SQUELCH CIRCUIT
Turns audio preamplifier Q10 on and off.
CARRIER SQUELCH OPERATION
With no carrier detected, Q9 collector is high positive, keeping Q10 turned off. When carrier is detected, U1-12 squelch detector output causes Q7 emitter and Q8 base to go low. When Q8 base goes low enough, Schmitt trigger Q8-Q9 changes state. Q9 collector goes low and Q10 turns on.
EEPS-28437-O

SQUELCH CIRCUIT VOLTAGE TABLE

MEASUREMENT	DC VOLTAGE READINGS	
POINT	1000 UV CARRIER AT ANT.	NO CARRIER
Q7 EMITTER	0 VOLTS	3-4
Q8 COLLECTOR	4	0.2-0.3
Q9 BASE	0.75	0.2-0.3
Q9 COLLECTOR	0.1-0.3	8-8.5

NOTES:

1. Unless otherwise noted, resistor values are in ohms, and capacitor values are in picofarads.
2. Meaning of suffix letters on voltage notations are as follows:
   T = Transmitter keyed
   R = Receive (transmitter unkeyed)
   U = Receiver unsquelched
   S = Receiver fully squelched
3. Unless otherwise noted, dc voltages are measured with a 20,000 ohm-per-volt meter, and rf voltages are measured with an rf voltmeter (a Boonton 92B or equivalent).
4. U2 voltages measured with volume control fully counterclockwise (minimum volume).
5. When measuring pin 1, U1 reduce the rf level at the antenna until pin 1 level peaks out. The pin 1 level should be approximately 190 mV with 2.0 mV rf at the antenna.
6. M9494 is an alternate transistor for M9632.
7. Audio voltages measured with ± 3000 kHz deviation at 1000 Hz tone with rf level 1000 uV at ant.

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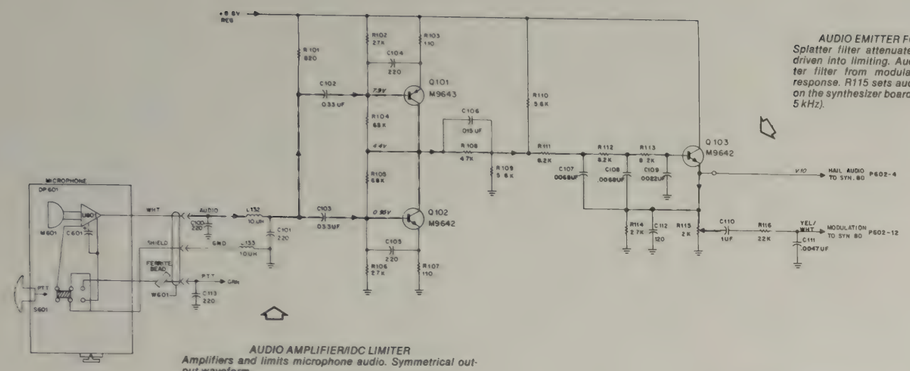
(Sheet 1 of 2)
4/10/79-IH

NAUTILUS 440

VHF MARINE RADIO
THE TRITON SERIES

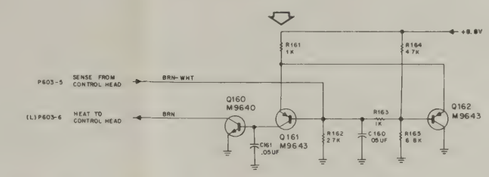
TRANSMITTER SECTION



AUDIO AMPLIFIER/IDC LIMITER
Amplifiers and limits microphone audio. Symmetrical output waveform.

AUDIO EMITTER FOLLOWER/SPLATTER FILTER
Splatter filter attenuates harmonics when IDC limiter is driven into limiting. Audio emitter follower isolates splatter filter from modulator load to ensure proper filter response. R115 sets audio level for modulation of the VCO on the synthesizer board (not to exceed 5 kHz).

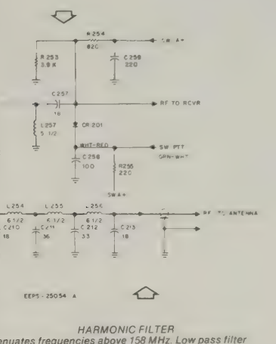
LCD AND XTAL TEMPERATURE REGULATOR
Warms reference osc xtal and LCD if temperature is below 5°C. Q161 and Q162 form a differential amplifier whose operation depends on the voltage difference determined by RT501 (RT501 is mounted under LCD substrate heater). Differential amplifier controls Q160, which controls current in heater resistors (R301 for reference oscillator and substrate heater R506 for LCD). Q160 is off at temperatures above 5°C.



ANTENNA SWITCH
Isolates receiver input during transmission. Network C256-L257-C257 = 1/4 wave transmission line when CR201 is forward biased.

Receive: SW PTT ungrounded. CR201 reverse biased. 1/4 waveline input Z = 50 ohms. PA output circuit is high impedance to received RF when Q132 is not driven. RF is conducted to receive RF input.

Transmit: SW PTT grounded. CR201 forward biased (short circuit). Short at 1/4 waveline output reflects "open" at line input. Transmit RF is blocked from receiver RF input.

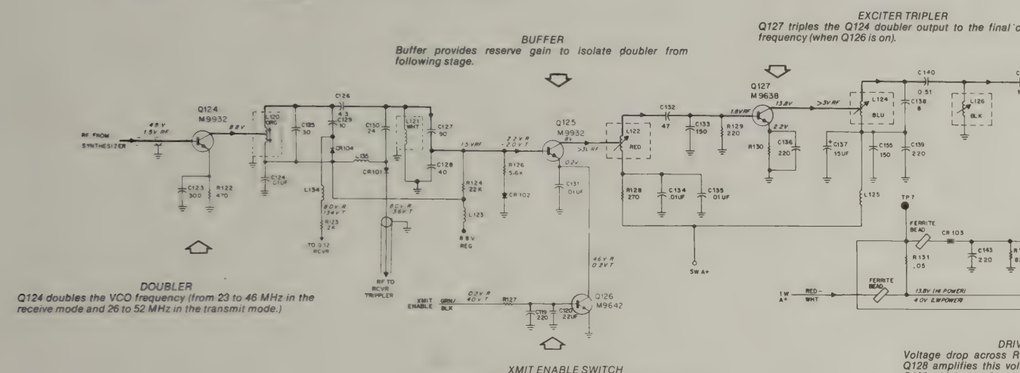


CONTROLLED RF AMPLIFIER
Gain controlled by drive regulator. Gain increases when PA current decreases, and vice-versa.

EXCITER OUTPUT AMPLIFIER
Drives 25 watt power amplifier.

CLASS C RF AMPLIFIER

HARMONIC FILTER
Attenuates frequencies above 158 MHz. Low pass filter



DOUBLER
Q124 doubles the VCO frequency (from 23 to 46 MHz in the receive mode and 26 to 52 MHz in the transmit mode.)

BUFFER
Buffer provides reserve gain to isolate doubler from following stage.

EXCITER TRIPLER
Q127 triples the Q124 doubler output to the final carrier frequency (when Q126 is on).

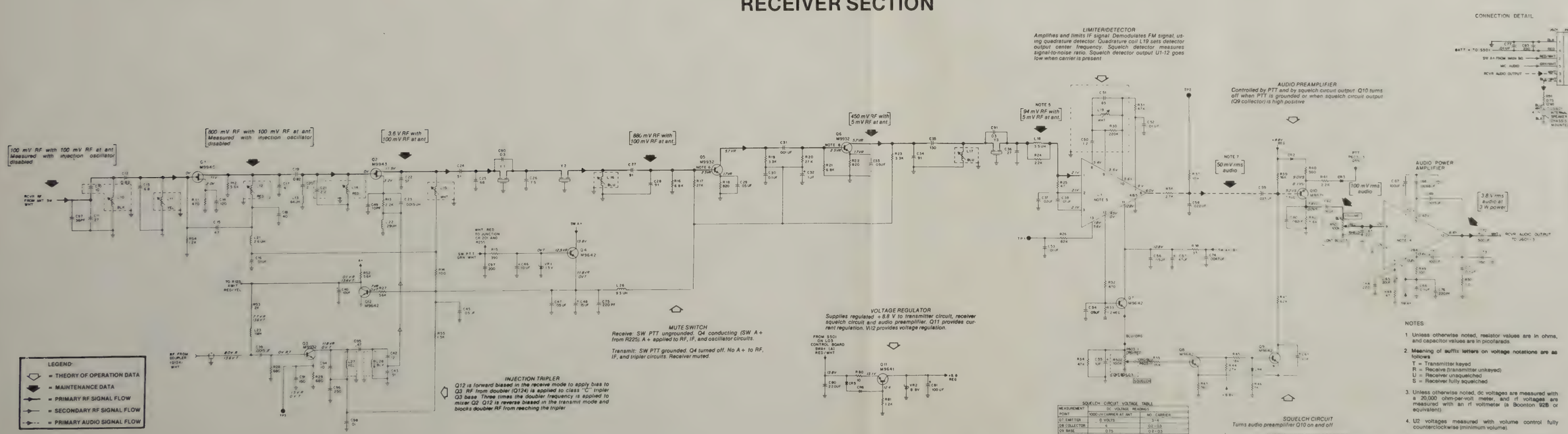
XMIT ENABLE SWITCH
Q126 activates transmitter by dc grounding buffer. Xmit enable line from synthesizer board controls Q126.

DRIVE REGULATOR
Voltage drop across R131 provides PA current sensing. Q128 amplifies this voltage to control operating point of Q129 which therefore controls RF gain of Q130. Power set control R134 sets normal operating point of Q129. Increased PA current causes decreased Q129 conduction which decreases transmiter drive from Q130.

NOTES:
1. Unless otherwise noted, resistor values are in ohms, and capacitor values are in picofarads.
2. Voltage notations are as follows:
   T = Transmitter Keyed
   R = Receiver (Transmitter Unkeyed)
   U = Receiver Unsquelch
   S = Receiver Fully Squelched
3. Unless otherwise noted, DC voltages are measured with a 20,000 ohm-per-volt meter, and RF voltages are measured with an RF voltmeter.

LEGEND
- THEORY OF OPERATION DATA
- PRIMARY RF SIGNAL FLOW
- PRIMARY AUDIO FLOW

RECEIVER SECTION



LIMITER/DETECTOR
Amplifies and limits IF signal. Demodulates FM signal, using quadrature detector. Quadrature coil L19 sets detector output center frequency. Squelch detector measures signal-to-noise ratio. Squelch detector output U1-12 goes low when carrier is present

AUDIO PREAMPLIFIER
Controlled by PTT and by squelch circuit output. Q10 turns off when PTT is grounded or when squelch circuit output (Q9 collector) is high positive

MUTE SWITCH
Receive: SW PTT ungrounded. Q4 conducting (SW A+ from R225). A+ applied to RF, IF, and oscillator circuits.

Transmit: SW PTT grounded. Q4 turned off. No A+ to RF, IF, and tripler circuits. Receiver muted.

INJECTION TRIPLER
Q12 is forward biased in the receive mode to apply bias to Q3. RF from doubler (Q124) is applied to class "C" tripler Q3 base. Three times the doubler frequency is applied to mixer. Q2. Q12 is reverse biased in the transmit mode and blocks doubler RF from reaching the tripler

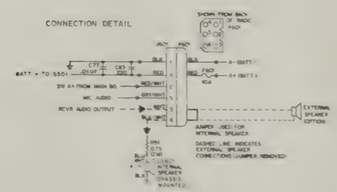
VOLTAGE REGULATOR
Supplies regulated +8.8 V to transmitter circuit, receiver squelch circuit and audio preamplifier. Q11 provides current regulation. Vr12 provides voltage regulation.

SQUELCH CIRCUIT
Turns audio preamplifier Q10 on and off

CARRIER SQUELCH OPERATION
With no carrier detected, Q9 collector is high positive, keeping Q10 turned off. When carrier is detected, U1-12 squelch derector output causes Q7 emitter and Q8 base to go low. When Q8 base goes low enough, Schmitt trigger Q8-Q9 changes state. Q9 collector goes low and Q10 turns on

SQUELCH CIRCUIT VOLTAGE TABLE

MEASUREMENT POINT	DC VOLTAGE READINGS 1000 UV CARRIER AT ANT	NO CARRIER
Q7 EMITTER	0 VOLTS	3-4
Q8 COLLECTOR	4	Q2-Q3
Q9 BASE	0.75	Q2-Q3
Q9 COLLECTOR	Q1-Q3	8-9 V



CONNECTION DETAIL

NOTES

1. Unless otherwise noted, resistor values are in ohms, and capacitor values are in picofarads.
2. Meaning of suffix letters on voltage notations are as follows:
   T = Transmitter keyed
   R = Receive (transmitter unkeyed)
   U = Receiver unsquelched
   S = Receiver fully squelched
3. Unless otherwise noted, dc voltages are measured with a 20,000 ohm-per-volt meter, and rf voltages are measured with an rf voltmeter (a Boonton 92B or equivalent)
4. U2 voltages measured with volume control fully counterclockwise (minimum volume).
5. When measuring pin 1, U1 reduce the rf level at the antenna until pin 1 level peaks out. The pin 1 level should be approximately 190 mV with 2.0 mV rf at the antenna.
6. MM494 is an alternate transistor for MM932
7. Audio voltages measured with ± 3000 kHz deviation at 1000 Hz tone with rf level 1000 uV at ant

LEGEND:
- = THEORY OF OPERATION DATA
- = MAINTENANCE DATA
- = PRIMARY RF SIGNAL FLOW
- = SECONDARY RF SIGNAL FLOW
- = PRIMARY AUDIO SIGNAL FLOW

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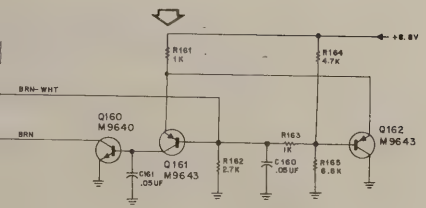
(Sheet 1 of 2)
4/10/79-IH

ECTION

NAUTILUS 440

VHF MARINE RADIO
THE TRITON SERIES

.CD AND XTAL TEMPERATURE REGULATOR
reference osc xtal and LCD if temperature is below
161 and Q162 form a differential amplifier whose
on depends on the voltage difference determined
01 (RT501 is mounted under LCD substrate heater).
atial amplifier controls Q160, which controls cur-
heater resistors (R301 for reference oscillator and
te heater R506 for LCD). Q160 is off at
atures above 5°C.



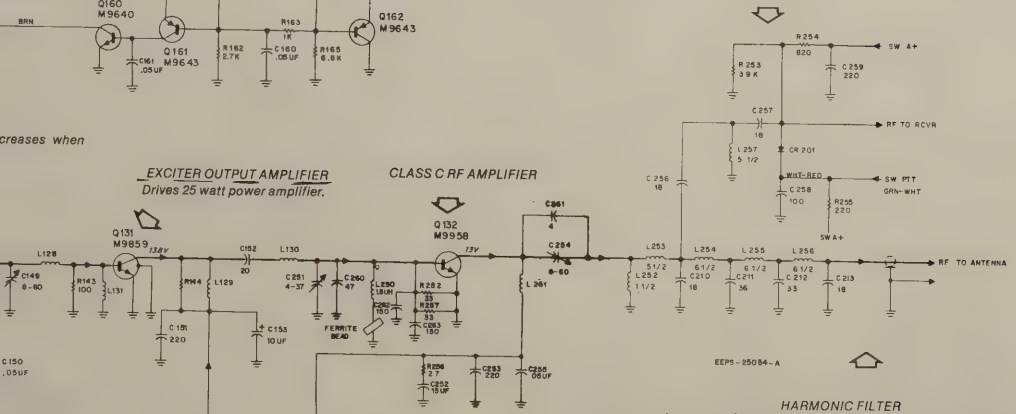
creases when

ANTENNA SWITCH

Isolates receiver input during transmission. Network C256-L257-C257 = 1/4 wave transmission line when CR201 is forward biased.

Receive: SW PTT ungrounded. CR201 reverse biased. 1/4 waveline input Z = 50 ohms. PA output circuit is high impedance to received RF when Q132 is not driven. Rf is conducted to receive RF input.

Transmit: SW PTT grounded. CR201 forward biased (short circuit). Short at 1/4 waveline output reflects "open" at line input. Transmit RF is blocked from receiver RF input.



HARMONIC FILTER
Attenuates frequencies above 158 MHz. Low pass filter.

NOTES:
1. Unless otherwise noted, resistor values are in ohms, and capacitor values are in picofarads.
2. Voltage notations are as follows:
   T = Transmitter Keyed
   R = Receiver (Transmitter Unkeyed)
   U = Receiver Unsquelch
   S = Receiver Fully Squelched
3. Unless otherwise noted, DC voltages are measured with a 20,000 ohm-per-volt meter, and RF voltages are measured with an RF voltmeter.

LEGEND

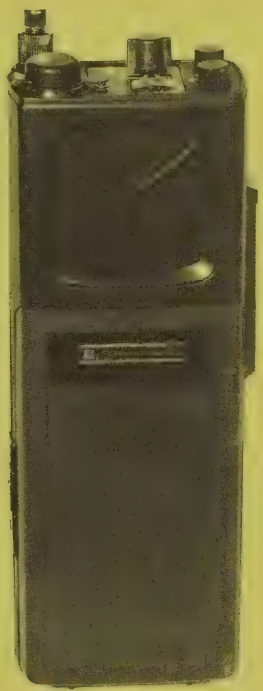
- THEORY OF OPERATION DATA
- PRIMARY RF SIGNAL FLOW
- PRIMARY AUDIO FLOW

PRICE: $1.00/Copy

SR-C 830S50

Instruction Sheet "A"

PARTS LIST
SCHEMATIC DIAGRAM
PRINTED CIRCUIT BOARDS
EXPLODED PARTS VIEW
FCC DATA
CRYSTAL INFORMATION



VHF/FM
MARINE HAND-HELD RADIO TELEPHONE

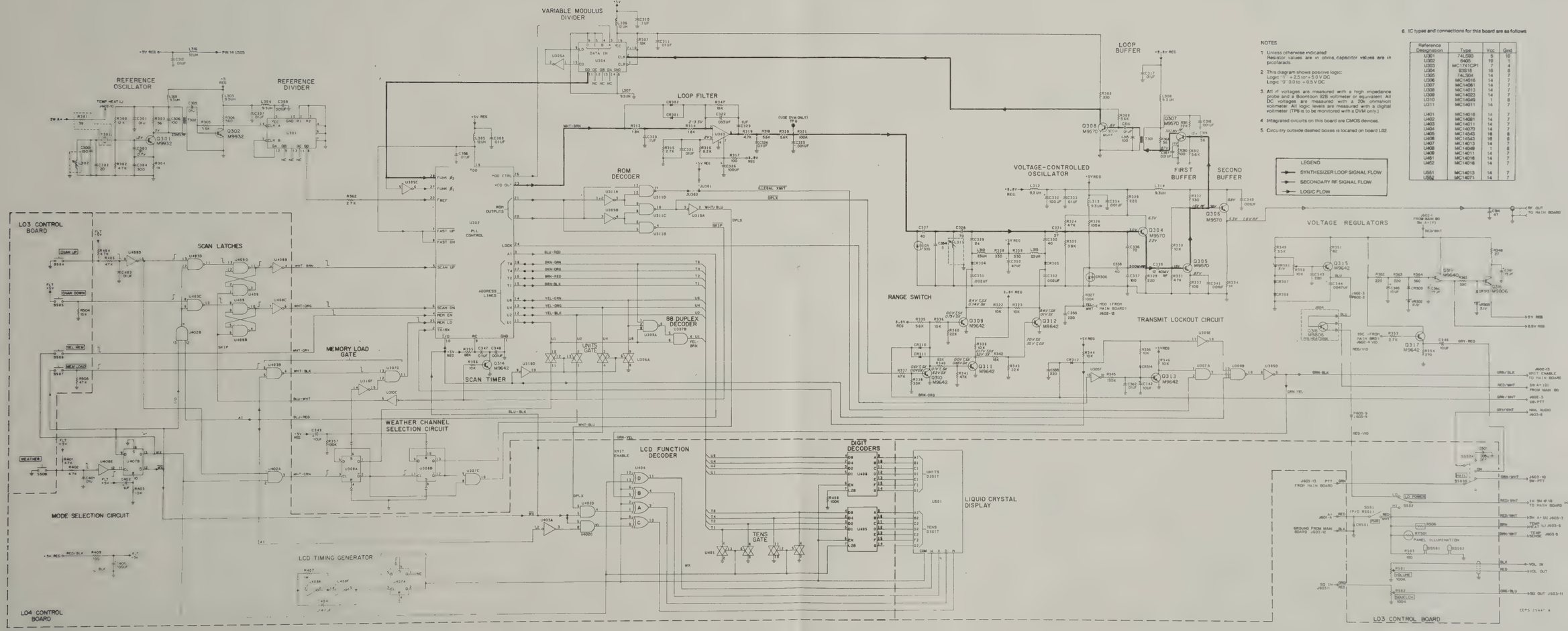
The SCC part number for this item is 830S05AU161.
Please refer to this number in all correspondence.

STANDARD COMMUNICATION CORP.

2/75

3729564A1

50 CHANNEL SYNTHESIZER


REFERENCE OSCILLATOR
REFERENCE DIVIDER
VARIABLE MODULUS DIVIDER
LOOP FILTER
ROM DECODER
PLL CONTROL
LOOP BUFFER
VOLTAGE-CONTROLLED OSCILLATOR
FIRST BUFFER
SECOND BUFFER
RANGE SWITCH
TRANSMIT LOCKOUT CIRCUIT
VOLTAGE REGULATORS
LO3 CONTROL BOARD
SCAN LATCHES
MEMORY LOAD GATE
SCAN TIMER
WEATHER CHANNEL SELECTION CIRCUIT
MODE SELECTION CIRCUIT
LCD TIMING GENERATOR
LO4 CONTROL BOARD
LCD FUNCTION DECODER
DIGIT DECODERS
TENS GATE
UNITS GATE
88 DUPLEX DECODER
LIQUID CRYSTAL DISPLAY
NOTES
1 Unless otherwise indicated: Resistor values are in ohms, capacitor values are in microfarads
2 This diagram shows positive logic: Logic "1" = 2.5 to +5.0 V DC Logic "0" 0.0 to +0.5 V DC
3 All rf voltages are measured with a high impedence probe and a Boontoon 92S voltmeter or equivalent. All DC voltages are measured with a 20k ohms/volt voltmeter. All logic levels are measured with a digital voltmeter. (TP8 is to be monitored with a DVM only.)
4 Integrated circuits on this board are CMOS devices.
5 Circuitry outside dashed boxes is located on board L02.
6 IC types and connections for this board are as follows
LEGEND
SYNTHESIZER LOOP SIGNAL FLOW
SECONDARY RF SIGNAL FLOW
LOGIC FLOW

Reference Designation	Type	Vcc	Gnd
U301	74LS90	5	10
U302	8405	19	1
U303	MC1741CP1	7	4
U304	92S16	16	8
U305	74LS04	14	7
U306	MC14016	14	7
U307	MC14081	14	7
U308	MC14013	14	7
U309	MC14023	14	7
U310	MC14049	1	8
U311	MC14011	14	7
U401	MC14016	14	7
U402	MC14081	14	7
U403	MC14011	14	7
U404	MC14070	14	7
U405	MC14543	16	8
U406	MC14543	16	8
U407	MC14013	14	7
U408	MC14049	1	8
U409	MC14011	14	7
U451	MC14016	14	7
U452	MC14016	14	7
U551	MC14013	14	7
U552	MC14071	14	7

The SCC part number for this item is 830S05AU161.
Please refer to this number in all correspondence.

PARTS LIST

The following Parts List includes all electrical parts except 1/8 watt, ±10%, fixed composition resistors, for which values are shown on the schematic. The right-hand column references each particular part of its corresponding location on the printed circuit board. Those components for which the grid location shows an asterisk (*) are not mounted on the P.C. board.

REF. DESIGN	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION
C001	30pF	Fixed Ceramic	DD15300020	F1
C002, 023, 059	10pF	Fixed Ceramic	DD12100060	G1, F5, C2
060, 061, 062				D2, C3, *
063, 071, 074				G1, G3, G4
099				*
C003, 010	0.8pF	Fixed Ceramic	DD16008010	F1, F3
C004	3pF	Fixed Ceramic	DD11030010	F1
C006, 007, 009	0.001pF	Fixed Ceramic	DK17102010	F2, G2, F2
C008	7pF	Fixed Ceramic	DD12070040	F2
C011	15pF	Fixed Ceramic	DD16150040	F3
C012, 013	5pF	Fixed Ceramic	DD10050020	F3, P3
C014, 015, 018	0.01uF	Fixed Ceramic	DK78103010	G3, F3, F4
028, 033, 035				H6, I6, I5
067, 070, 073				G1, G3, H3
077, 079, 082				G5, H6, I6
085, 087				H4, H3
C016, 017	10pF	Fixed Ceramic	DD12100060	F4, F4
C019, 072	1pF	Fixed Ceramic	DD10010020	04, G4
C020, 024, 032	0.01uF	Fixed Ceramic	DK18103030	F4, F5, H5
045, 109				G2, H1
110				I1
C021	0.6pF	Fixed Ceramic	DD16006010	F4
C022	0.005uF	Fixed Ceramic	DK17502010	F5
C025	0.04uF	Fixed Film	DF17403010	F6
C026	470pF	Fixed Ceramic	DK16471010	G5
C029, 031, 034	470pF	Fixed Ceramic	DK16471010	H5, I5, I5
036, 037, 102				I5, H5, *
107				*
C027, 030, 066	200pF	Fixed Ceramic	DD16201030	H5, H5, G1
075, 078				G5, H6
C038, 043	0.033uF	Fixed Film	DF17333010	I4, I4
C039, 080, 091	0.01uF	Fixed Film	DF17103010	H5, I6, H3
092				H3
C040, 041	500pF	Fixed Ceramic	DD16501010	H4, H4
C042	0.01 uf	Fixed Film	DF17103010	I4
C044, 090	0.047uf; 35VDC	Fixed Electrolytic	EW47303510	I4, H3
C046	0.033uF; 25VDC	Fixed Electrolytic	EW33402510	H2
C047	1uF; 25VDC	Fixed Electrolytic	EW10501510	I3
C048, 049	0.047uF	Fixed Film	DF17472010	I3, I3
C050	10uF; 16VDC	Fixed Electrolytic	EA10601690	H1
C051	33uF; 16VDC	Fixed Electrolytic	EA33601090	I2
C052	0.001uF	Fixed Film	DF17102010	H1
C053, 054	47uF; 16VDC	Fixed Electrolytic	EA47601690	I1, R2
C055, 056, 057	0 to 20pF	Variable Ceramic	CT12000020	C2, D2, D2
058, 098				*, *
C064, 069	100pF	Fixed Ceramic	DD15101020	G1, G3
C065	50pF	Fixed Ceramic	DD15500040	G2
C076	60pF	Fixed Ceramic	DD15600010	G5
C083	100uF; 6VDC	Fixed Electrolytic	EA10704690	R6
C088	0.04uF	Fixed Film	DF17403030	H4
C089, 096, 097	0.22uF; 25VDC	Fixed Electrolytic	EW22402510	H3, O5, P5
C094	10uF; 10VDC	Fixed Electrolytic	EV10601030	H2
C095	4.7uF; 16VDC	Fixed Electrolytic	EV47501610	H2
C100	.001uF	Fixed Ceramic	DK17102010	H2
C101	4.7uF 35VDC	Fixed Ceramic	EA47503590	*
C103	40pF	Fixed Ceramic	DD15400030	G2
C102, 107	470pF	Fixed Ceramic	DK16471010	*, G2
C104	68pF	Fixed Ceramic	DD16680010	G3
C108, 109	0.01uF	Fixed Ceramic	DK18103030	*, H1
110				I1
C111	51pF	Fixed Mica	DF36510010	P4
C401, 402, 403	30pF	Fixed Mica	DF363300020	A2, B1, C1
404, 428, 471				*, D6, *
C405, 406, 407	20pF	Trimmer	CT12000020	A2, A1, B1
408, 433, 438				*, C5, B4
448, 472				A4, *

REF. DESIGN	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION
C409	160pF	Mica	DF35161500	F1
C410, 411	50pF	Fixed Ceramic	DD15500080	E2, F2
C412	51pF	Mica	DF36510010	E2
C413, 457	10uF;	Electrolytic	EA10601690	E2, D3
458	16VDC			D3
C414, 419	0.01uF	Fixed Ceramic	DK18103030	E2, E4
422, 427				E5, D6
464				D4
C415	0.005uF	Fixed Ceramic	DK17502010	F2
C418	0.01uF	Fixed Ceramic	DK18103010	E3
C416, 417	120pF	Fixed Ceramic	DD16121010	E2, E3
C420, 424	3pF	Fixed Ceramic	DD11030010	N4, E6
C421, 431, 432	0.01uF	Fixed Ceramic	DK17102010	E5, D5, D6
435, 436, 442				C5, B5, B6
444, 449, 474				A5, A4, E4
478				*
C423, 425, 434	39pF	Fixed Mica	DF36390010	E5, E5, C5
C426	50pF	Fixed Ceramic	DD15500040	E6
C429	5pF	Fixed Ceramic	DD11050030	D5
C430	10pF	Fixed Mica	DF36100020	D5
C437	15pF	Fixed Ceramic	DF16150030	B5
C439, 440	40pF	Fixed Ceramic	dd15400010	A5, B5
C441	50pF	Fixed Ceramic	DD16500010	B5
C443, 446	10pF	Fixed Ceramic	DD12100010	A5, A5
447				A4
C450, 453, 462	1uF;	Fixed Electrolytic	DK16471010	C3, D3, D3
479, 480, 481	10VDC			D6, M3, M5
482				C3
C452	1uF;	Fixed Electrolytic	EW10501010	D3
	10VDC			
C454, 455	33uF;	Fixed Electrolytic	EV33600310	D3, D3
	3VDC			
C466	33uF;	Fixed Electrolytic	EW33600310	D4
	3VDC			
C456	0.0033uF	Fixed Film	DF17332010	D3
C459, 460	22uF;	Fixed Electrolytic	EW22402510	E4, E4
	25VDC			
C463	0.0022uF	Fixed Film	DF17223010	D3
C465	33uF;	Fixed Electrolytic	EA33601090	D4
	10VDC			
C467	10uF;	Fixed Electrolytic	EW10601010	C4
	10VDC			
C468	47uF;	Fixed Electrolytic	EA47601690	I2
	16VDC			
C469	4.7uF;	Fixed Electrolytic	EA47503590	B5
	35VDC			
C473	20pF	Fixed Mica	DF36200020	D6
C477	4.7uF;	Fixed Electrolytic	EW47500610	E3
	6VDC			
C488, 489	20pF	Fixed Ceramic	DD16200010	N2, N3
DIODES:				
D001, 002		Germanium	HD1000150	I3, H3
D003, D010		Silcon	HD20001100	I3, *
D004, 005		Germanium	HD10001010	I6, I6
D006, 007		Silicon	HD20011050	H2, I3
404, 405, 407				D3, E4, C6
D401, 402		Silicon	HD20000120	A5, A6
D406		Zener	HD30023090	C5
INDUCTORS:				
L001, 002, 003		RF Tuning	LA50018020	F1, F1, F3
004				F3
L005		11.7 MHz IF	LI55016152	F4
L006		11.7 MHz IF	LI55016182	F4
L007		11.7 MHz IF	LI55016132	F4
L008		11.7 MHz IF	LI55016140	F4
L009		455 kHz Discriminator	LI70030360	I4
L010		455 kHz Discriminator	LI70030350	I3
L011, 012		First Tripler	LI50028012	G2, G2
L013, 014		Second Tripler	LA50018030	G4, G4
L015, 017		RF Choke	LC13940010	H4, H4
L018		RF Choke	LC11220020	*
L401		Phase Modulator	LA55016010	E3
L402		First Tripler	LA70196040	E4
L403		First Tripler	LA70196050	E4
L404, 405		Second Tripler	LA50018030	E5, E5
L406, 407		Doubler	LC15000012	D5, D5
L407, 411, 412		Choke Coil	LC14000010	D5, B4, A5
L408		Driver	LC12800010	D5
L409		Choke Coil	LC13810020	C5
L410		PA	LM13422010	B5
L411, 415, 416		RF Tuning	LC13400010	B4, A5, A5
L412		RF Tuning	LC14000010	A5
L413		RF Choke	LC13810010	B5
L414		RF Choke	LC11610010	A5
L417		Choke Coil	LC22260020	D4
TRANSISTORS:				
Q001		FET	HF90001110	F2
Q002		MOSFET	HF400401B0	F3
Q003, 004, 005		NPN SILICON	HT305351B0	F4, F5, H5
006, 007, 008		NPN SILICON		H5, I5, I5
009, 012, 013				H4, G2, G3
014, 015				G5, H6
Q010		PND SILICON	HT106831B0	I1
Q011		NPN SILICON	HT313831B0	G1
Q016, 017, 018		NPN SILICON	HT309451Q0	G3, H3, G2
Q401, 402, 403		NPN SILICON	HT305351B0	E1, E2, F3
404				E4
Q405, 406, 407		NPN SILICON	HT30387110	E6, D6, D5
Q408		NPN SILICON	HT30730100	C4
Q409		NPN SILICON	HT309451Q0	D4
Q410		NPN SILICON	HT312131B0	C6
Q411		PNP GERMANIUM	HT106731B0	B6

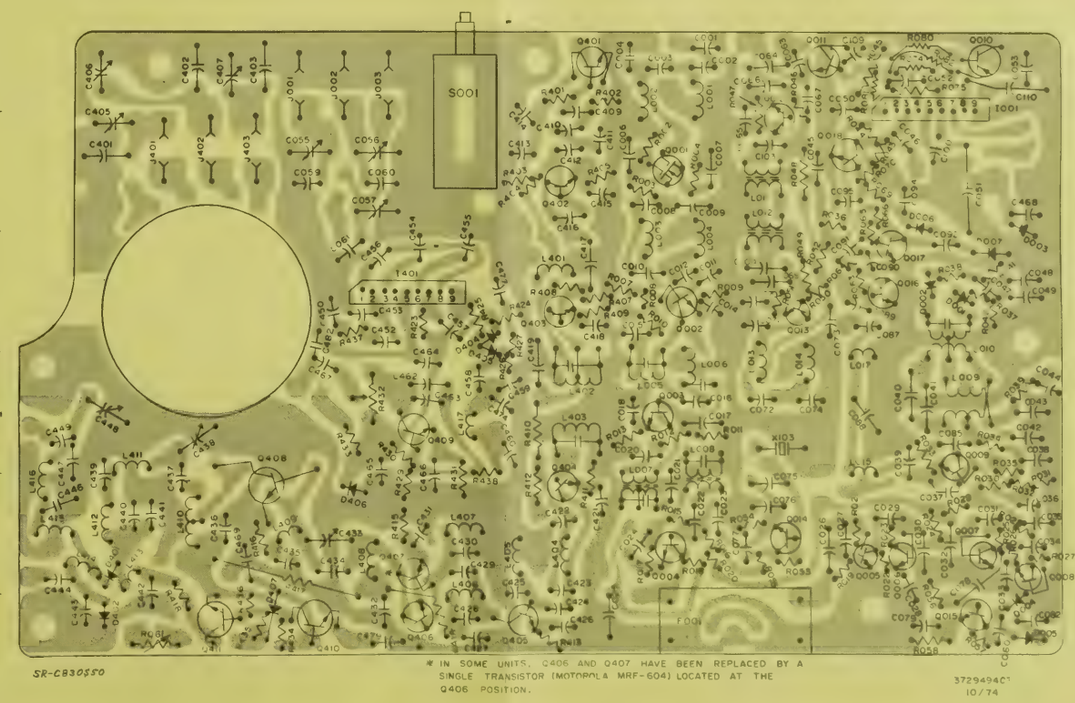
REF. DESIGN	VALUE	TYPE	SCC PART NO.	P.C. BOARD LOCATION
RESISTORS:				
R040	25,000 ohm W/Switch	Variable (Vol/Off)	RB12530022	*
R061	47,000 ohm	Variable (Meter Adj.)	RA04730010	B6
R062	5000 ohm	Variable (Deviation)	RB05020042	*
R080	68 ohm, ¼W	Fixed Composition	GC10680180	H1
R081	22 ohm, ¼W	Fixed Composition	RC10022140	H1
R415	10 ohm, ¼W	Fixed Composition	RC10100140	D5
R432	2000 ohm	Trimmer	RA02020090	D4

NOTE: Resistors not listed in parts list are standard, fixed composition, ±10%, 1/8 watt. Resistance values (ohms) are shown on the schematic.

MISCELLANEOUS:				
A401		Antenna	YR04049012	*
E001		Speaker	QK00503050	*
F001	455KHZ	Ceramic Filter	FG455309E0	F6
I001		Integrated Circuit	HC10013030	I1
I401		Integrated Circuit	HC10014030	D3
J001		Socket	YJ03000020	C1
J004		Jack	YJ01000740	*
J402, 403		Socket	YJ03000020	B2, *
J404		Jack	YJ01000740	*
J405		Jack	YJ10000560	*
J406		Jack	YJ04000540	*
J407		Battery Case	YJ514000020	*
M001		Meter	LM11014032	*
M401		Microphone	MS40000020	*
P001		PWB	YD36530016	*
S001		T/R Switch	SG01020060	D1
S002		Rotary Switch	SR02050090	*
X001	156.3MHz	Quartz Crystal	XC41606661	*
X002	156.8MHz	Quartz Crystal	XB41612221	*
X003	12.155 MHz	Quartz Crystal	XA21215505	*
X004	X-Tal Filter	Quartz Crystal	XU411700N5	*
X401	156.3MHz	Quartz Crystal	XP48683332	*
X402	156.8MHz	Quartz Crystal	XP48711112	*

SR-C830S50 TX-RX P.C. BOARD (FOIL SIDE) LAYOUT

370849902


A B C D E F G H I
1
2
3
4
5
6
S001
* IN SOME UNITS, Q406 AND Q407 HAVE BEEN REPLACED BY A SINGLE TRANSISTOR (MOTOROLA MRF-604) LOCATED AT THE Q406 POSITION.

SR-C830S50 TX-RX P.C. BOARD (COMPONENT SIDE) LAYOUT

372949403

PARTS LIST

REF. DESIGN	TYPE	SCC PART NO.
SELECTED PARTS:		
O101	CASE	3729064014
O103	NAME PLATE	3729203010
O107	INDICATOR	3729265023
O108	INDICATOR	3729265100
O109	PUNCHED PLATE	3653003010
O110	COLLAR	3729055034
O111	KNOB	3653154012
O112	KNOB	3653154012
O113	NUT	53228089E2
O114	KNOB	3782154010
O121	LID	3653257018
O123	LID	3653257024
O125	ESCUTCHEON	3653063014
O127	ESCUTCHEON	3737063023
O128	INSULATOR	3729120032
O129	BUTTON	3512270013
O130	TERMINAL	YL03010220
O131	HOLDER	3512211013
O133	INDICATOR	3653265032
O135	BRACKET	3653160013
O206	STICKER	3653122010
O207	STICKER	3653122010
O208	STICKER	3653122010
O209	STICKER	3653122020
O211	BRACKET	3653160045
O212	SUPPORT	3653101010
O216	CONTACTOR	3653123010
O217	CONTACTOR	3653123010
O222	PIN	3512254020
O226	SPRING	71101599L0
O228	BRACKET	3512160100
O232	HOLDER	3737271010
O234	LUG	62020029E0
O235	LUG	62020029E0
O323	PROTECTOR	3653269010
O327	LEVER	3653354022
O335	INSULATOR	3539120060
O334	INSULATOR	3539120060
O402	INDICATOR	3653265102
O407	COVER	3653053022
O420	TERMINAL	YL14020020
O431	LUG	62150019E0
O432	SPACER	3653118020
O433	SPACER	3653118020
O527	SCREW	51142606H0
O528	SCREW	51142606H0
O530	SCREW	51142604H0
O532	SCREW	51042604H0
O533	SCREW	51042604H0
O534	SCREW	50042604B0
O535	SCREW	50042604B0

Single-Unit Battery Charger

1. DESCRIPTION

The NLN9580A Single-Unit Battery Charger is an accessory item for the SENSAR Series Radio Pagers using rechargeable batteries. It is approved for use with the Motorola Type NLN7335A Nickel-Cadmium Battery.

The unit operates from a nominal 115Vac source and will recharge the nickel-cadmium battery in or out of the pager. Two separate charging compartments permit simultaneous charging of a spare battery while charging the battery installed in the pager. Two light-emitting-diode (LED) indicators are provided to display charging conditions in the PAGER and spare BATTERY compartments.

To protect against over charging and possible harm to the equipment, the charger includes a timing circuit that automatically switches the unit to a lower current rate (trickle charge condition) after a predetermined period of charging time.

2. SPECIFICATIONS

INPUT POWER	115Vac ±15Vac, 50-60Hz
OUTPUT	6mA at 1.3Vdc (at charging rate)
SIZE	2½" × 2½" × 2½" (64mm × 64mm × 64mm)
WEIGHT w/XFMR.	8.75oz. (250g.)
FULL RECHARGE TIME	15 hours for 40 hours of normal operation
PART RECHARGE TIME	3 hours for 8 hours of normal operation
TEMPERATURE RANGE	41° to 113°F (+5° to +45°C)

3. OPERATION

a. Battery in Pager

(1) Insert the transformer (T1) plug into a nominal 115Vac receptacle.

(2) Turn the pager off.

(3) Insert the pager into the charger compartment, with the pager's pocket clip up and facing away from the charger's LED indicators. Make sure that the pager slides all the way down to the bottom of the compartment. The red LED (PAGER) will light to indicate that the battery is charging.

NOTE

If desired, the pager may be turned on and operated in the charger, while the battery is being charged. However, allow about 50% more time to reach full charge. Also, if a page is received while the battery is being charged, and the pager includes the manual reset option, reset the pager immediately after the alert. The pager draws up to 40mA while alerting and the battery will not charge properly if the pager is not reset.

(4) Allow sufficient time for the battery to charge. If the pager has been operating for 40 hours under normal operating conditions, charge it for a minimum of 15 hours with the pager turned off, or 23 hours with the pager turned on. If the pager has been operating for eight hours under normal operating conditions, charge it for a minimum of three hours.

b. Battery Removed from Pager

(Refer to Figure 1.)

(1) Flip open the spare battery compartment door located on the back side of the charger. On the inside of the door, notice the area shaped like the nickel-cadmium battery. This is the battery holding area.

(2) Place the battery (+ side down) into the holding area and close the battery compartment door. The yellow LED (BATTERY) will light to indicate that the battery is charging.

(3) Allow sufficient time for the battery to charge (15 hours for 40 hours of normal pager operation, or three hours for eight hours of normal pager operation).

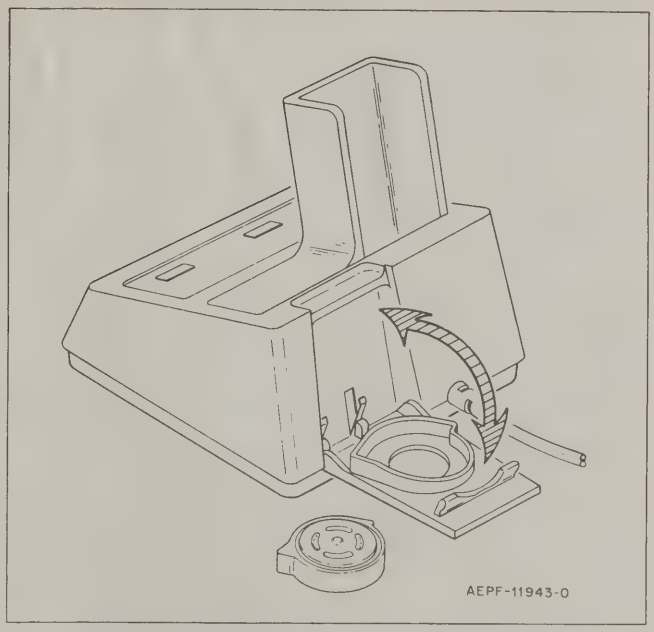


Figure 1. Spare Battery Compartment Detail

c. Precautions

Disposable batteries are not rechargeable. However, if a pager with a disposable battery is placed in the charger, or a disposable battery placed in the spare battery charging compartment, no damage will result. The shape of the nickel-cad-

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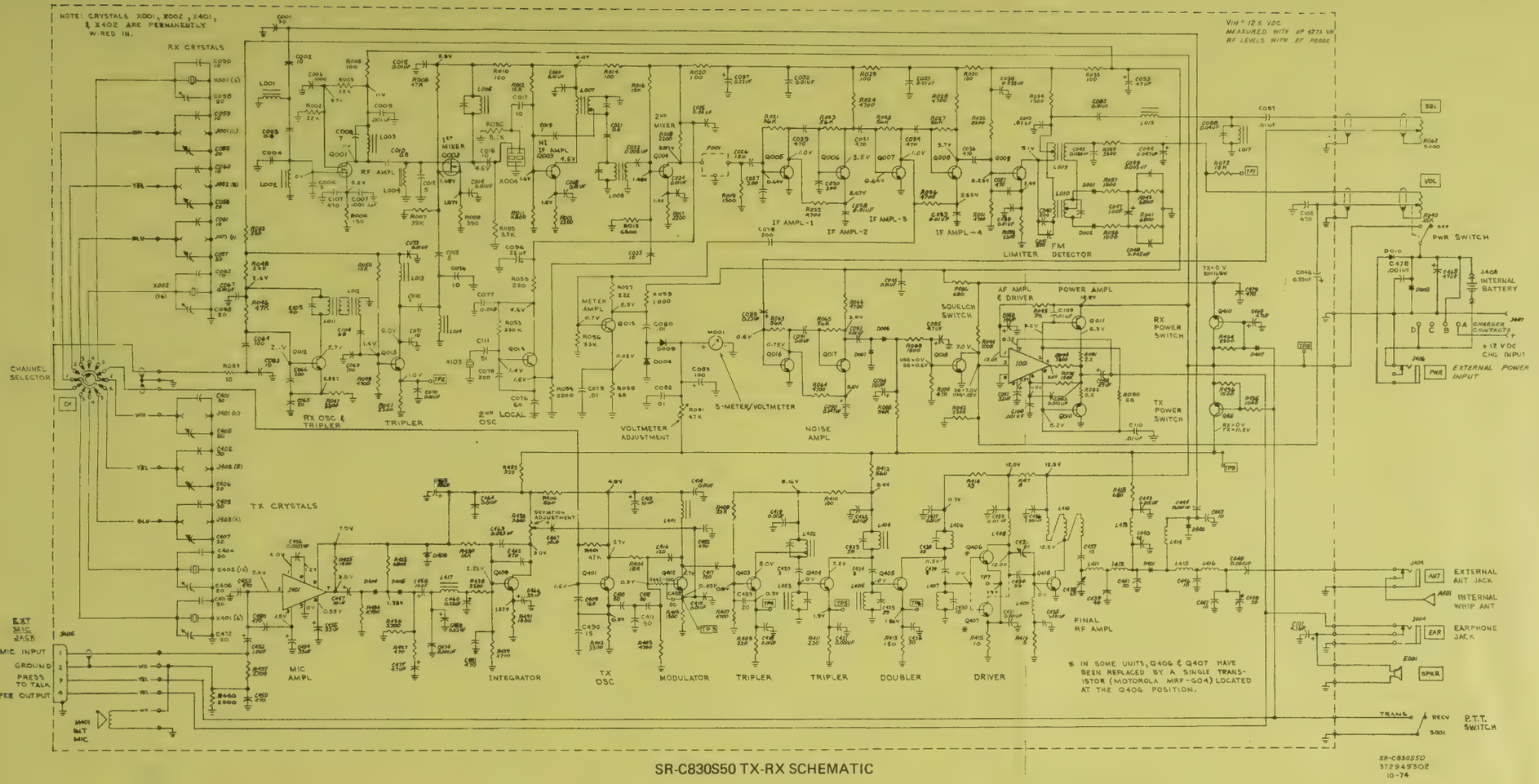


SR-C830S50 TX-RX SCHEMATIC

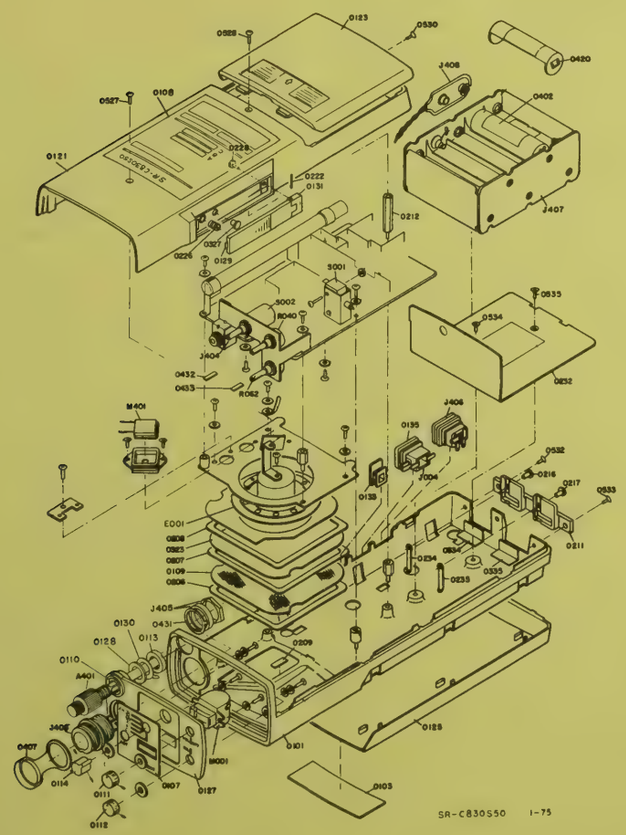
FCC DATA	
TRANSMITTER TYPE ACCEPTANCE NO.	172
FINAL INPUT POWER	1.375 watts
FREQUENCY TOLERANCE	±.001%
TYPE EMISSION	16 F 3
RECEIVER MODEL NO.	SR-C830S50
REFERENCE FCC PART NOS.	21, 81, 83, 89, 91 and 93

SCHEMATIC NOTES

(1) Unless otherwise specified, resistance values are in ohms, ±10%, 1/8 watt.
(2) Capacitance values are in pico-farads when not marked, and in micro-farads when followed by a "uF".
(3) All schematic-indicated voltages are to common ground (chassis), using a VTVM (HP 427A or equivalent). Use RF probe when measuring RF circuits.
(4) All voltage measurements are taken with 13.8 VDC regulated input as a power source.
(5) The circuit board layout illustrates component location from the bottom (foil) side, for aid in locating a particular component, or test point.
(6) Crystals X001, X002, X401, and X402 are permanently wired in the circuit.

CRYSTAL INFORMATION

ORDERING CRYSTALS: When ordering Crystals, specify the desired operating frequency. The transmitter crystal is an S.C.C. type TXI and receiver crystal is type RXI.



SR-C830S50 EXPLODED PARTS VIEW

PARTS LIST

REF. DESIGN	TYPE	SCC PART NO.
SELECTED PARTS:		
O101	CASE	3729064014
O103	NAME PLATE	3729203010
O107	INDICATOR	3729265023
O108	INDICATOR	3729265100
O109	PUNCHED PLATE	3653003010
O110	COLLAR	3729055034
O111	KNOB	3653154012
O112	KNOB	3653154012
O113	NUT	53228089E2
O114	KNOB	3782154010
O121	LID	3653257018
O123	LID	3653257024
O125	ESCUTCHEON	3653063014
O127	ESCUTCHEON	3737063023
O128	INSULATOR	3729120032
O129	BUTTON	3512270013
O130	TERMINAL	YL03010220
O131	HOLDER	3512211013
O133	INDICATOR	3653265032
O135	BRACKET	3653160013
O206	STICKER	3653122010
O207	STICKER	3653122010
O208	STICKER	3653122010
O209	STICKER	3653122020
O211	BRACKET	3653160045
O212	SUPPORT	3653101010
O216	CONTACTOR	3653123010
O217	CONTACTOR	3653123010
O222	PIN	3512254020
O226	SPRING	71101599L0
O228	BRACKET	3512160100
O232	HOLDER	3737271010
O234	LUG	62020029E0
O235	LUG	62020029E0
O323	PROTECTOR	3653269010
O327	LEVER	3653354022
O335	INSULATOR	3539120060
O334	INSULATOR	3539120060
O402	INDICATOR	3653265102
O407	COVER	3653053022
O420	TERMINAL	YL14020020
O431	LUG	62150019E0
O432	SPACER	3653118020
O433	SPACER	3653118020
O527	SCREW	51142606H0
O528	SCREW	51142606H0
O530	SCREW	51142604H0
O532	SCREW	51042604H0
O533	SCREW	51042604H0
O534	SCREW	50042604B0
O535	SCREW	50042604B0

PRICE: $1.00/Copy

SR-C 830S50

Instruction Sheet "A"

PARTS LIST
SCHEMATIC DIAGRAM
PRINTED CIRCUIT BOARDS
EXPLODED PARTS VIEW
FCC DATA
CRYSTAL INFORMATION

VHF/FM

MARINE HAND-HELD RADIO TELEPHONE

The SCC part number for this item is 830S05AU161. Please refer to this number in all correspondence.

STANDARD COMMUNICATION CORP.

2/75

3729564A1

MOTOROLA

"SENSAR" SERIES
Radio Pagers

Single-Unit Battery Charger

1. DESCRIPTION

The NLN9580A Single-Unit Battery Charger is an accessory item for the SENSAR Series Radio Pagers using rechargeable batteries. It is approved for use with the Motorola Type NLN7335A Nickel-Cadmium Battery.

The unit operates from a nominal 115Vac source and will recharge the nickel-cadmium battery in or out of the pager. Two separate charging compartments permit simultaneous charging of a spare battery while charging the battery installed in the pager. Two light-emitting-diode (LED) indicators are provided to display charging conditions in the PAGER and spare BATTERY compartments.

To protect against over charging and possible harm to the equipment, the charger includes a timing circuit that automatically switches the unit to a lower current rate (trickle charge condition) after a predetermined period of charging time.

2. SPECIFICATIONS

INPUT POWER	115Vac ±15Vac, 50-60Hz
OUTPUT	6mA at 1.3Vdc (at charging rate)
SIZE	2½" × 2½" × 2½" (64mm × 64mm × 64mm)
WEIGHT w/XFMR.	8.75oz. (250g.)
FULL RECHARGE TIME	15 hours for 40 hours of normal operation
PART RECHARGE TIME	3 hours for 8 hours of normal operation
TEMPERATURE RANGE	41° to 113°F (+5° to +45°C)

3. OPERATION

a. Battery in Pager

(1) Insert the transformer (T1) plug into a nominal 115Vac receptacle.

(2) Turn the pager off.

(3) Insert the pager into the charger compartment, with the pager's pocket clip up and facing away from the charger's LED indicators. Make sure that the pager slides all the way down to the bottom of the compartment. The red LED (PAGER) will light to indicate that the battery is charging.

NOTE

If desired, the pager may be turned on and operated in the charger, while the battery is being charged. However, allow about 50% more time to reach full charge. Also, if a page is received while the battery is being charged, and the pager includes the manual reset option, reset the pager immediately after the alert. The pager draws up to 40mA while alerting and the battery will not charge properly if the pager is not reset.

(4) Allow sufficient time for the battery to charge. If the pager has been operating for 40 hours under normal operating conditions, charge it for a minimum of 15 hours with the pager turned off, or 23 hours with the pager turned on. If the pager has been operating for eight hours under normal operating conditions, charge it for a minimum of three hours.

b. Battery Removed from Pager

(Refer to Figure 1.)

(1) Flip open the spare battery compartment door located on the back side of the charger. On the inside of the door, notice the area shaped like the nickel-cadmium battery. This is the battery holding area.

(2) Place the battery (+ side down) into the holding area and close the battery compartment door. The yellow LED (BATTERY) will light to indicate that the battery is charging.

(3) Allow sufficient time for the battery to charge (15 hours for 40 hours of normal pager operation, or three hours for eight hours of normal pager operation).

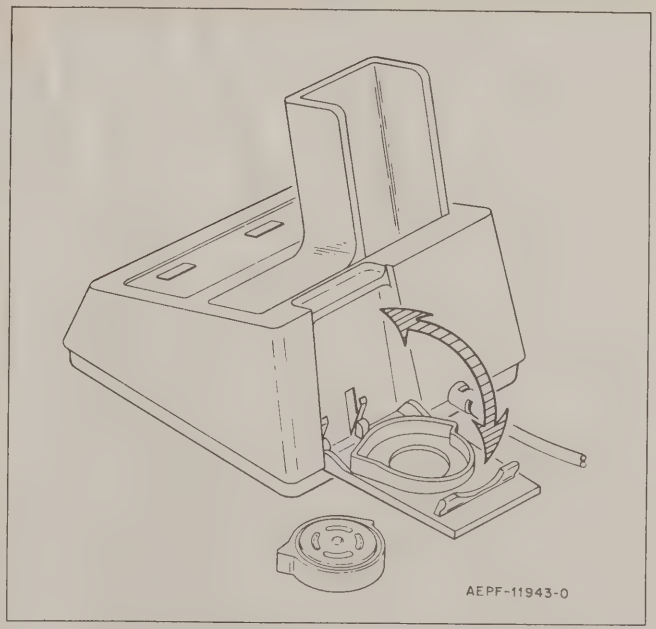


Figure 1. Spare Battery Compartment Detail

c. Precautions

Disposable batteries are not rechargeable. However, if a pager with a disposable battery is placed in the charger, or a disposable battery placed in the spare battery charging compartment, no damage will result. The shape of the nickel-cad-

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mium battery and the mechanics of the battery charger prevent the application of charging voltage when a disposable battery is in use.

The batteries require no special storage precautions. They may be stored at normal room temperature in any state of charge without detrimental effects.

WARNING

Do not discard old batteries in fire; they may explode.

4. THEORY OF OPERATION

Refer to schematic diagram.

a. General

The battery charger contains two similar charging circuits, one circuit (Q1, Q2, U2) for charging a battery while in the pager and a second circuit (Q3, Q4, U3) for charging a battery removed from the pager. Although the two circuits work independently, they both receive timing and power from common sources; timing from module U1 and power from transformer/converter T1.

Either charging circuit, with a battery installed, supplies 6mA of charging current to the battery for approximately 30 hours. After the 30-hour cycle, the charging current is reduced to 0.6mA, which is maintained indefinitely. The LEDs turn on and remain on, regardless of charging rate, as long as a battery is installed in the charger.

b. Circuit Description

Only one charging circuit will be analyzed, but the description applies to both circuits.

Input power (115Vac) is converted to 7.6 ± 1.5Vdc, (B+) by transformer/converter T1, and distributed throughout the charger. With B+ applied, integrated circuit U1 provides system timing via an output pulse train at U1 pin 3 (approximately one pulse every 2.4 seconds). The pulses are routed to U2 pin 3 (clock input).

With no battery in the charger, Q1, Q2, and CR1 are biased off, C1 is discharged, and U2 is reset. With a battery inserted across the charging contacts, Q2 and CR1 conduct, and U2 pin 6 (TRIG) switches from a low to high state. The divider output at U2 pin 8 ($\overline{Q}$) then goes low, turning on Q1 and controlling the charging current through the battery. Resistor R2 is chosen to limit this current to 6mA. Capacitor C1 charges and TRIG switches to the low state. A counter in U2 now begins counting the clock pulses from U1. Signal $\overline{Q}$ remains low and Q1 remains on until 2^{15} clock pulses are received from U1 (approximately 30 hours).

At the end of this time, $\overline{Q}$ goes high and turns off Q1, which opens the charge path through R2 and leaves only the trickle charge path though resistor R3. The trickle charge current set by R3 is 0.6mA. As long as battery contact is made (normal charge and trickle charge), Q2 is on and CR1 is illuminated.

When the battery is removed (battery contact open), Q2 turns off, CR1 turns off, and C1 discharges through resistors R5 and R6. Resistor R6 prevents rapid discharge of C1 through U2, which prevents TRIG from going high should battery contact bounce (falsing) occur.

5. MAINTENANCE

CAUTION

This battery charger contains devices sensitive to static discharge. Therefore, extreme care should be taken and a ground strap should be worn when handling and testing the circuit board. Review MOS handling precautions.

a. Charging Current

To check battery charging current, connect a dc ammeter (0-10mA) across the charging contacts as follows:

(1) Pager Compartment

The contact pin (spring loaded) in the bottom of the compartment is positive (+), and the contact toward the side of the compartment is negative (−). With the proper ac power applied, the meter should indicate about 6mA. The red LED indicator should light when the meter is connected.

(2) Spare Battery Compartment

The contact in the center of the compartment is negative (−) and the other pin is positive (+). With the proper ac power applied to the charger, the meter should indicate 6mA. The yellow indicator should light when the meter is connected.

b. Troubleshooting

If troubleshooting the battery charger is necessary, perform the following steps:

(1) remove ac power from the unit.

(2) remove screw from bottom of charger.

(3) remove circuit board from charger housing.

(4) refer to circuit board detail and locate the test point.

(5) simulate a battery in the circuit being checked by shorting across the charging contacts on the circuit board.

(6) plug T1 into proper ac power receptacle.

(7) refer to the two symptom/analysis flow charts. (These charts refer to the pager battery charging circuit, but apply equally to the spare battery charging circuit.)

When troubleshooting is complete and repairs have been made, remove the (simulated battery) short that was added in step (5) before putting the charger back into operation.

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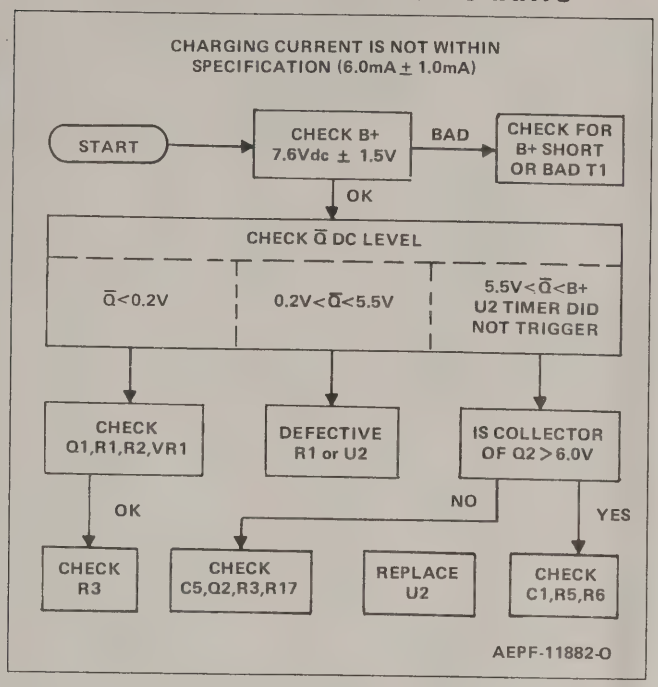
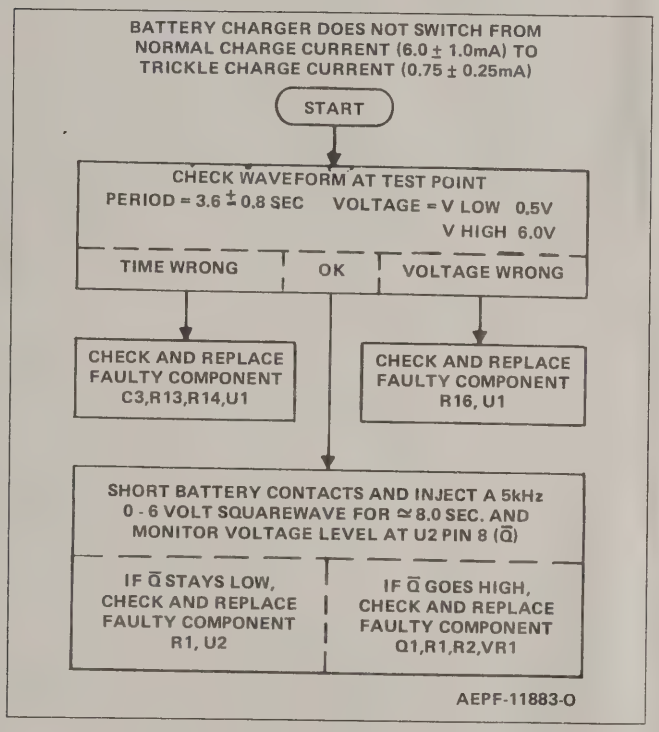
SYMPTOM ANALYSIS FLOW CHARTS




BATTERY CHARGER DOES NOT SWITCH FROM NORMAL CHARGE CURRENT (6.0 ± 1.0mA) TO TRICKLE CHARGE CURRENT (0.75 ± 0.25mA)
START
CHECK WAVEFORM AT TEST POINT
PERIOD = 3.6 ± 0.8 SEC
VOLTAGE = V LOW 0.5V
V HIGH 6.0V
TIME WRONG
OK
VOLTAGE WRONG
CHECK AND REPLACE FAULTY COMPONENT C3,R13,R14,U1
CHECK AND REPLACE FAULTY COMPONENT R16, U1
SHORT BATTERY CONTACTS AND INJECT A 5kHz 0 - 6 VOLT SQUAREWAVE FOR ≃8.0 SEC. AND MONITOR VOLTAGE LEVEL AT U2 PIN 8 (Q̄)
IF Q̄ STAYS LOW, CHECK AND REPLACE FAULTY COMPONENT R1, U2
IF Q̄ GOES HIGH, CHECK AND REPLACE FAULTY COMPONENT Q1,R1,R2,VR1
AEPF-11883-O

NLN9580A Battery Charger

TPLF-3042-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: uF ± 20%; 35V unless stated
C1, 2	2383397D14	.047
C3	2305341K01	3.9; 50V
C4	2383397D26	0.47
C5, 6	2105457G08	.01 ± 10%; 50V
		DIODE: See Note
CR1	4805729G08	Red, LED
CR2	4805729G13	Yellow, LED
CR3	4882363E03	Silicon
		TRANSISTOR: See Note
Q1, 3	4800869681	PNP, Type M9681
Q2, 4	4800869643	PNP, type M9643
		RESISTOR, Fixed: Ω ± 5%; ⅛W unless stated
R1	0660075A70	7.5k
R2	0610621B74	619 ± 1%; ¼W
R3	0660075A70	7.5k
R4	0660075A33	220
R5, 6	0660075B10	330k
R7	0660075A70	7.5k
R8	0610621B74	619 ± 1%; ¼W
R9	0660075A70	7.5k
R10	0660075A33	220
R11, 12, 13	0660075B10	330k
R14	0660075B17	620k
R16, 17, 18	0660075A73	10k
R19, 20	0660075A97	100k
R21	0660075C17	47
R22, 23	0660075A49	1k
		TRANSFORMER:
T1	2505933M02	AC-to-DC Converter; includes W1 CORD
		INTEGRATED CIRCUIT: See Note
U1	5184320A35	Timer; type MC1455
U2, 3	5184887K83	Timer/Divider; type MC14541
		DIODE, Zener: See Note
VR1, 2	4805189E04	3.9V ± 5%
W1	-----	CORD, 2-conductor; part of T1
		NONREFERENCED ITEMS
	0105953J56	ASSEMBLY, Housing; includes housing, nameplate, and channel guide
	0105953J57	ASSEMBLY, Bottom Cover; includes bottom cover, model label, and two base pads
	0300138399	SCREW, Phillips head; 6-20 × ⅝"
	0505415M01	EYELET (works in conjunction with and is retained by the positive contact)
	0705565M01	BRACKET, Center (located over top of positive contact and eyelet)
	1505425M01	COVER, Battery compartment
	3905420M01	CONTACT, Positive (retains eyelet)
	3905421M01	CONTACT, Spare battery; 2 required
	3905559M01	CONTACT, Negative (approximately 1" long, mates with antenna sleeve)
	4205416M01	RETAINER, LED; nylon (2 required)
	8405888K02	CIRCUIT BOARD

NOTE: For optimum performance, order replacement diodes, transistors, and integrated circuits by Motorola part number only.

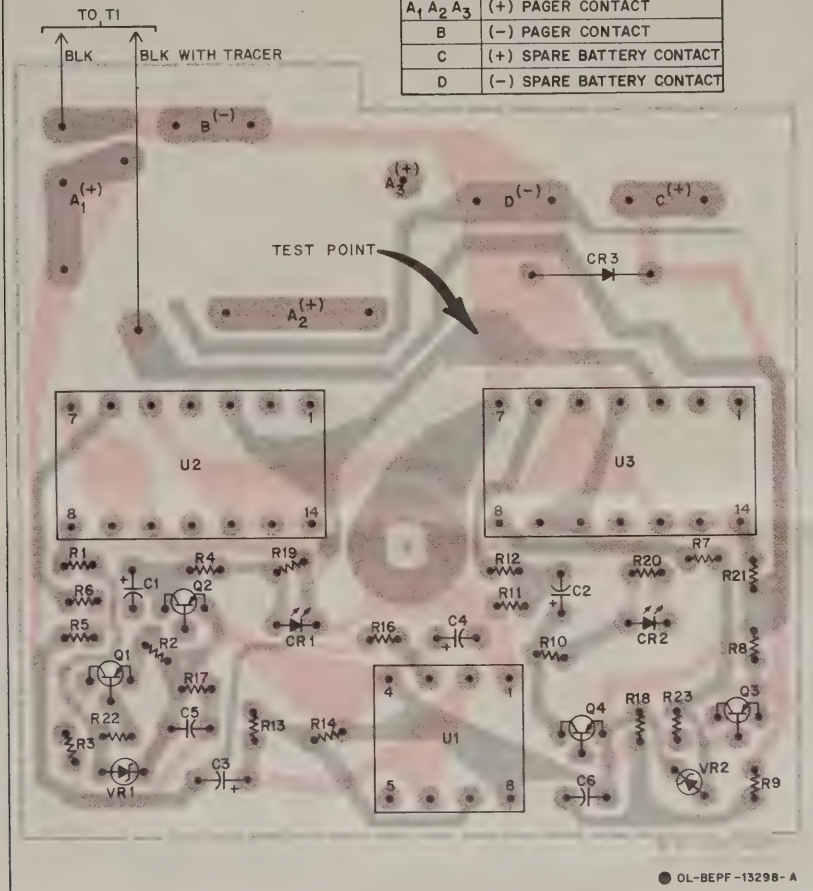
BACK-DATING INFORMATION

TPLF-1311-O

ITEM NO.	REF. SYMBOL / CHANGES	LOC.	CHANGED TO
NLN9580A	CR3 Added Q1, Q3 Changed (were 4800869643) R1, R7 Changed (were 0660075A76, 13k ± 5%; ⅛W) R2, R8 Changed (were 0684444A18, 750 ± 10%; ¼W) R21 Added R22 Added R23 Added T1 Changed (was 2505735J01) VR1, VR2 Changed (were 4883461E40, 5.1V ± 1%)	Coll. of Q3 to Gnd. U3 pin 12 Q1 Base Q3 Base	NLN9580A-1

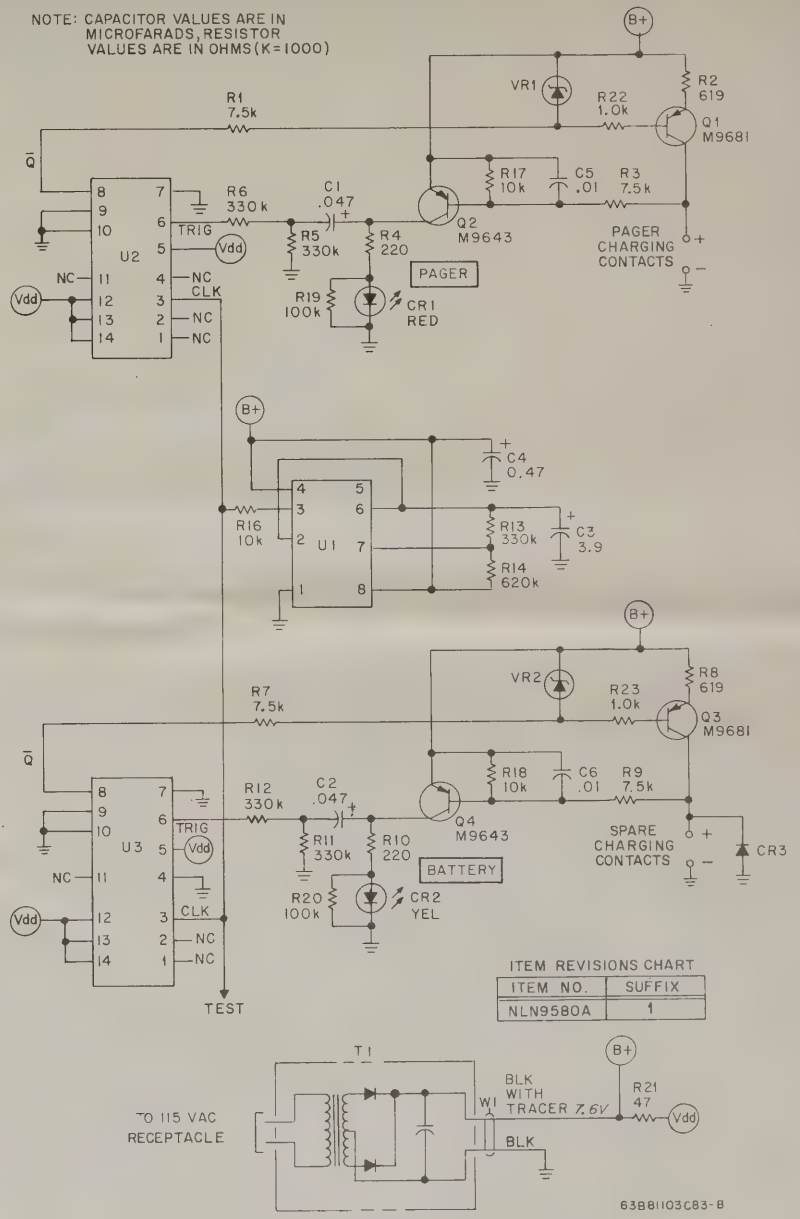
VIEWED FROM COMPONENT SIDE

POINT	FUNCTION
A_1 A_2 A_3	(+) PAGER CONTACT
B	(−) PAGER CONTACT
C	(+) SPARE BATTERY CONTACT
D	(−) SPARE BATTERY CONTACT



OL-BEPF-13298-A

NOTE: CAPACITOR VALUES ARE IN MICROFARADS, RESISTOR VALUES ARE IN OHMS (K=1000)



CIRCUIT BOARD DETAIL AND SCHEMATIC DIAGRAM

Add this information to your manual.

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EPF-11413-A

MOTOROLA

INSTRUCTION MANUAL REVISION

for

Manual No. 68P81012C58-B
"MT500" UHF Radios

FMR-1095
Issue- 1

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to supplement your manual. Installation of these changes in earlier equipment is not necessary except as recommended in Motorola Service and Repair Notes (SRN's).

REVISION DETAILS

No.	Change Affects	Item Number	Suffix
1	Schematic Diagram & Parts List	NUE6311A	2
		NUE6312A	7
		NUE6313A	5
		NUE6380A	1

CHANGES

No.	Ref. Sym.	Action	Part No.	Description
1	C25	changed to	21840^8H20	CAPACITOR, .082uF ±20%; 50V